MALCOLM PIRNIE

ARCS II

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

CONTRACT NO. 68-W9-0051

LI TUNGSTEN-CAPTAIN'S COVE ADJUNCT
GLEN COVE, NEW YORK
Work Assignment No. 025-2L4L

DRAFT FINAL WORK PLAN - VOLUME I
FOCUSSED FEASIBILITY STUDY

Remedial Planning Activities at Selected Uncontrolled Hazardous Substance Disposal Sites USEPA Region II (NY, NJ, PR, VI)

Malcolm Pirnie, Inc.
104 Corporate Park Drive
White Plains, New York 10602

December 1997

MALCOLM PIRNIE

ARCS II CONTRACT NO. 68-W9-0051

WORK ASSIGNMENT # 025-2L4L

SITE NAME: LI TUNGSTEN SITE - CAPTAIN'S COVE ADJUNCT
GLEN COVE, NEW YORK

DRAFT FINAL WORK PLAN - VOLUME I
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DECEMBER 1997

CONTRACTOR QA/QC SIGN-OFF

Malcolm Pirnie, Inc., has reviewed this draft document in accordance with the contractor's ARCS II Quality Assurance Procedures Manual SOP (MP-PMOQA-006-12/90, Revision 1) and is submitting it to USEPA, Region II under Work Assignment No. 025-2L4L and Contract No. 68-W9-0051.

This document has not been approved by USEPA Region II and is not intended for release to the public.

Joseph A. Guerriero TASK LEADER	Dennis G. McGrath ARCS II PROGRAM/OPERATIONS MANAGER
Date: December 16, 1997	Date: December 16, 1997

FOCUSSED FEASIBILITY STUDY
LI TUNGSTEN - CAPTAIN'S COVE ADJUNCT
GLEN COVE, NEW YORK
WORK ASSIGNMENT #025-2L4L

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LIST OF APPENDICES

1.0 INTRODUCTION

1.1 OVERVIEW

The purpose of this Draft Final Work Plan is to present the technical approach to conduct a Focussed Feasibility Study (FFS) and investigate the overall extent of radiological contamination on the Captain's Cove property. The activities to be conducted at Captain's Cove will consist of a FFS pursuant to the National Priorities List (NPL) listing of the Li Tungsten Corporation site. The link between the two sites was made based on evidence obtained by the USEPA in 1995 that the previous owners/operators of the Li Tungsten site disposed of tungsten ore residues at Captain's Cove. The Captain's Cove property (hereinafter referred to as the Site) is, therefore, considered an adjunct to the Li Tungsten site.

From the early 1970's through the early 1980's, the Site was a dump site for the disposal of incinerator ash, sewage sludge, rubbish, household debris, dredged material from Glen Cove Creek and industrial wastes. The Site was purchased by the Glen Cove Development Company (GCDC) from the City of Glen Cove in 1981 and became the object of a redevelopment effort (i.e., a condominium complex). In 1983, the Site was sold to Village Green Reality. Redevelopment efforts were abandoned in the mid-1980's when the New York State Department of Environmental Conservation (NYSDEC) designated the property as a State Superfund site. The NYSDEC is statutorily precluded from addressing the radioactive materials present on the Site pursuant to State Superfund law. The NYSDEC requested, therefore, that the USEPA address the radioactive contamination at the Site, while the State addresses the chemical contamination through a Consent Order with the City of Glen Cove (the former owner/operator of the dump) under the State Superfund program.

1.2 APPROACH TO DEVELOPMENT OF WORK PLAN

Malcolm Pirnie, Inc., (MPI) is submitting this Draft Final Work Plan to the USEPA in response to Work Assignment No.025-2L4L under the Alternative Remedial Contracting Strategy (ARCS) Contract No. 68-W9-0051. This Draft Final Work Plan presents the proposed technical scope of work for a FFS and includes a schedule for the performance of the work.

This Draft Final Work Plan has been prepared in accordance with current USEPA guidance. The following are several of the documents specifically applicable to preparation of a FFS that were considered in preparing this Draft Final Work Plan:

- Interim Final Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. OSWER Directive 9355.3-01. (USEPA, 1988a).

- Guidance for the Data Quality Objectives Process, Final. EPA QA/G-4, September 1994, (USEPA, 1994a).

- Interim Guidance of Superfund Selection of Remedy. OSWER Directive 9355.0-19, (USEPA, 1986a).

- Risk Assessment Guidance for Superfund, Volume I, Human Health Evaluation Manual, Part A (USEPA, 1989a).

- Superfund Exposure Assessment Manual (USEPA, 1986b).

- Draft Generic Work Plan Guidance (USEPA, 1989b).

- CERCLA Compliance with Other Laws Manual, Interim Final. EPA/540-9-89-006. Office of Emergency and Remedial Response, Washington, D.C. August 1988, 195 pp, (USEPA, 1988b).

- CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental and State Requirements (USEPA, 1989c)

Preparation of this Draft Final Work Plan was based upon a review and consideration of data, information, and discussions related to the following:

- Scoping meeting with the USEPA held on January 6, 1997.

- Ebasco, 1995. Final Site Screening Inspection (SSI) Report. Captain's Cove Condominium Site, Glen Cove, Nassau County, New York. Prepared by Ebasco Services Incorporated under USEPA Contract No. 68-W800110, Work Assignment No. 076-2JZZ, 5 volumes.

- Hart, 1989a. Remedial Investigation Work Plan, Garvies Point, Glen Cove, New York, Site No. 130032. Prepared by Fred C. Hart Associates, Inc., and RTP Environmental Associates, Inc. Final Draft - July 17, 1989.

- Hart, 1989b. Radiological Survey Work Plan, Garvies Point, Glen Cove, New York, Site No. 130032. Prepared by Fred C. Hart Associates, Inc., June 1, 1989.

- Hart, 1990. Radiological Survey Phase II Investigation Report, Garvies Point, Glen Cove, New York, Site. Prepared by Fred C. Hart Associates, Inc., and The NDL Organization, June 5, 1990.

- NYSDEC, 1997. Surficial Radiological Survey for Captain's Cove Condominium Site, Glen Cove, New York, 20 pages plus appendices.

- Roux, 1997. Draft RI/FS Work Plan. Prepared for the City of Glen Cove, NY by Roux Associates, Islandia, NY, May 1997.

- USGS, 1979. Topographic Map - Sea Cliff, New York Quadrangle, 1:24,000.

1.3 SCOPE OF WORK

The scope of work for this Draft Final Work Plan was outlined in the Work Assignment Form (WAF) Revision Nos. 15, 19 and 22 and the attached Statements of Work (SOW). WAF Revision No. 15 was transmitted to MPI from the USEPA in a letter from the Contracting Officer (CO) dated May 22, 1996; WAF Revision No. 19 was transmitted to MPI from the USEPA in a letter from the Contracting Officer (CO) dated July 14, 1997; WAF Revision No. 22 was transmitted to MPI from the USEPA in a letter from the Contracting Officer (CO) dated October 2, 1997. The SOWs identified nine standard tasks applicable to the FFS.

1.4 WORK PLAN ORGANIZATION

This Draft Final Work Plan is organized into eight sections of text including references. A brief description of each section follows.

Section 1.0, INTRODUCTION, presents an overview of the environmental conditions at the site, the approach used in developing the Draft Final Work Plan, the scope of work, and the organization and content of the Draft Final Work Plan.

Section 2.0, SITE BACKGROUND AND SETTING, presents the background of the site including the location, history and current conditions.

Section 3.0, INITIAL EVALUATION, presents an initial evaluation of the existing data base. This section includes a description of the types of wastes that were disposed of at the site, site geology and hydrogeology, climate, population and environmental resources, migration and exposure pathways, a preliminary identification of ARARs, a preliminary assessment of public health and environmental impacts, a summary of additional data requirements, and remedial action objectives.

Section 4.0, WORK PLAN RATIONALE, includes the Data Quality Objectives (DQOs) for field sampling and analytical activities, and the approach for preparing the Draft Final Work Plan, which illustrates how the activities will satisfy data needs.

Section 5.0, TASK PLANS FOR THE FFS, presents a proposed scope for each standard task of the FFS in accordance with the RI/FS guidance document (USEPA 1988a).

Section 6.0, PROJECT SCHEDULE, presents the anticipated schedule for the FFS tasks.

Section 7.0, PROJECT MANAGEMENT APPROACH, presents project management considerations that define relationships and responsibilities for selected task and project management teams.

Section 8.0, REFERENCES, provides a list of references used to develop material presented in this Draft Final Work Plan.

2.0 SITE BACKGROUND AND SETTING

2.1 SITE LOCATION

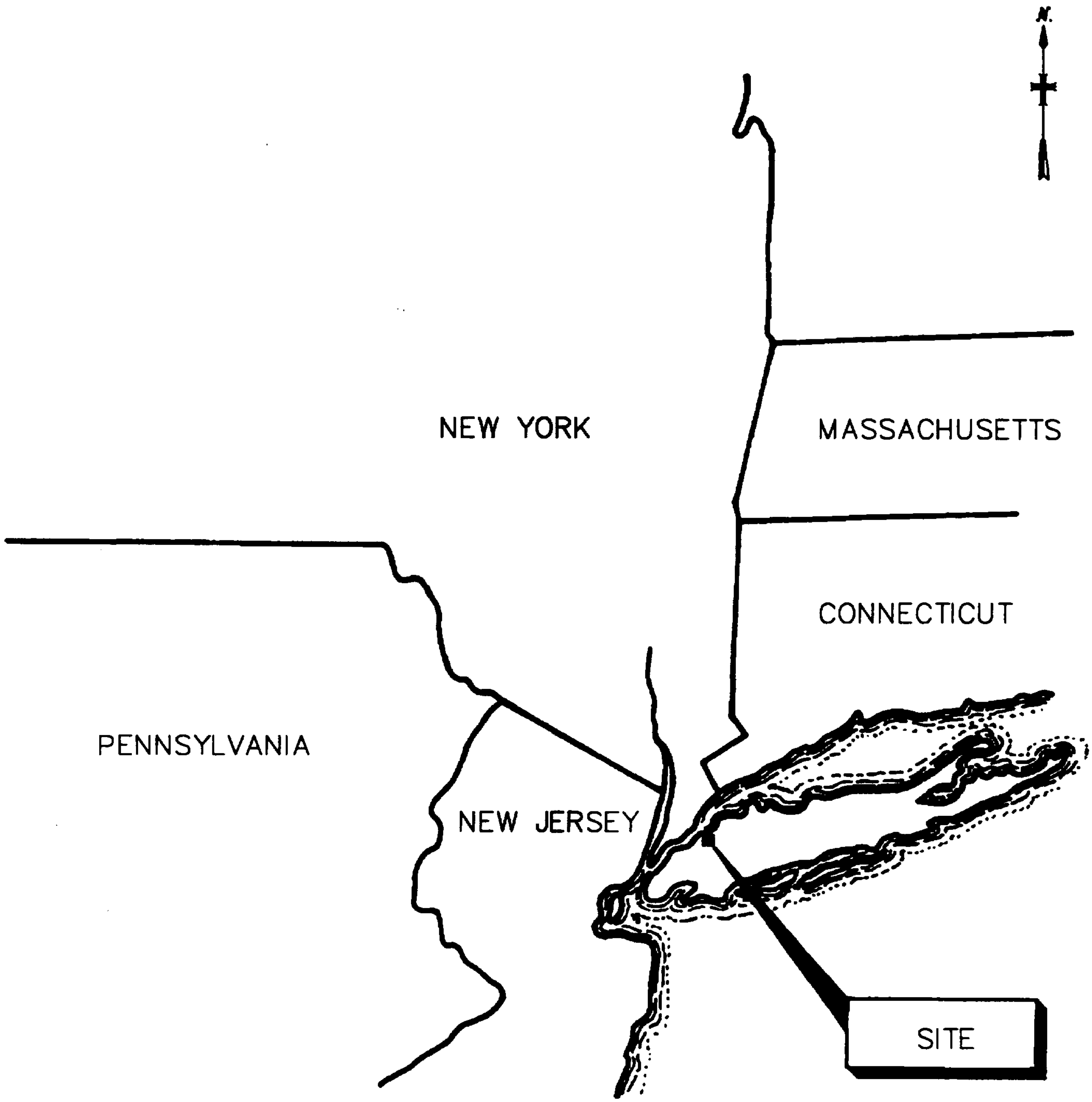
The Site is located on the north shore of Long Island in the City of Glen Cove, Nassau County, New York. Specifically, the Site is located at the end of Garvies Point Road on the northern side of Glen Cove Creek where the creek empties into Hempstead Harbor. A regional location map and site location map are presented in Figures 2-1 and 2-2, respectively. The Site is bordered on the west by a City beach, on the north by Garvies Point Road, on the east by the Glen Cove Anglers Club (a City-owned property) and on the south by Glen Cove Creek. A site plan is presented in Figure 2-3. The Li Tungsten Corporation site, a federal Superfund site, is located approximately 0.4 miles east of the Site.

The total area of the Site encompasses 19 acres including a four-acre wetland along Glen Cove Creek.

2.2 SITE HISTORY

The Site was formerly used as a disposal site for dredge materials from Glen Cove Creek. According to historical records (Hart, 1989a), dredging of Glen Cove Creek occurred in 1933-1934, 1948, 1960 and 1965. There are no available records on the disposal of approximately 195,000 cubic yards of material dredged in 1933-1934 and 26,500 cubic yards of material dredged in 1948. In 1960, 27,100 cubic yards of material were dredged from the lower portion of Glen Cove Creek and in 1965 6,300 cubic yards of dredged material were disposed of at the Site.

From approximately 1971 through the early 1980s, the Site was used by the City of Glen Cove as a municipal landfill. Incinerator residues, wastewater treatment plant sludges and street debris were disposed of at the Site (Hart, 1989a). During the period of time that the Site was being operated as a landfill, waste was accepted from the Li Tungsten site (Ebasco, 1995; C. Sweir - personal communication, 1997).



TITLE:	DATE:	FIGURE NO.:
REGIONAL LOCATION MAP	NOV. 1997	FIGURE 2-1

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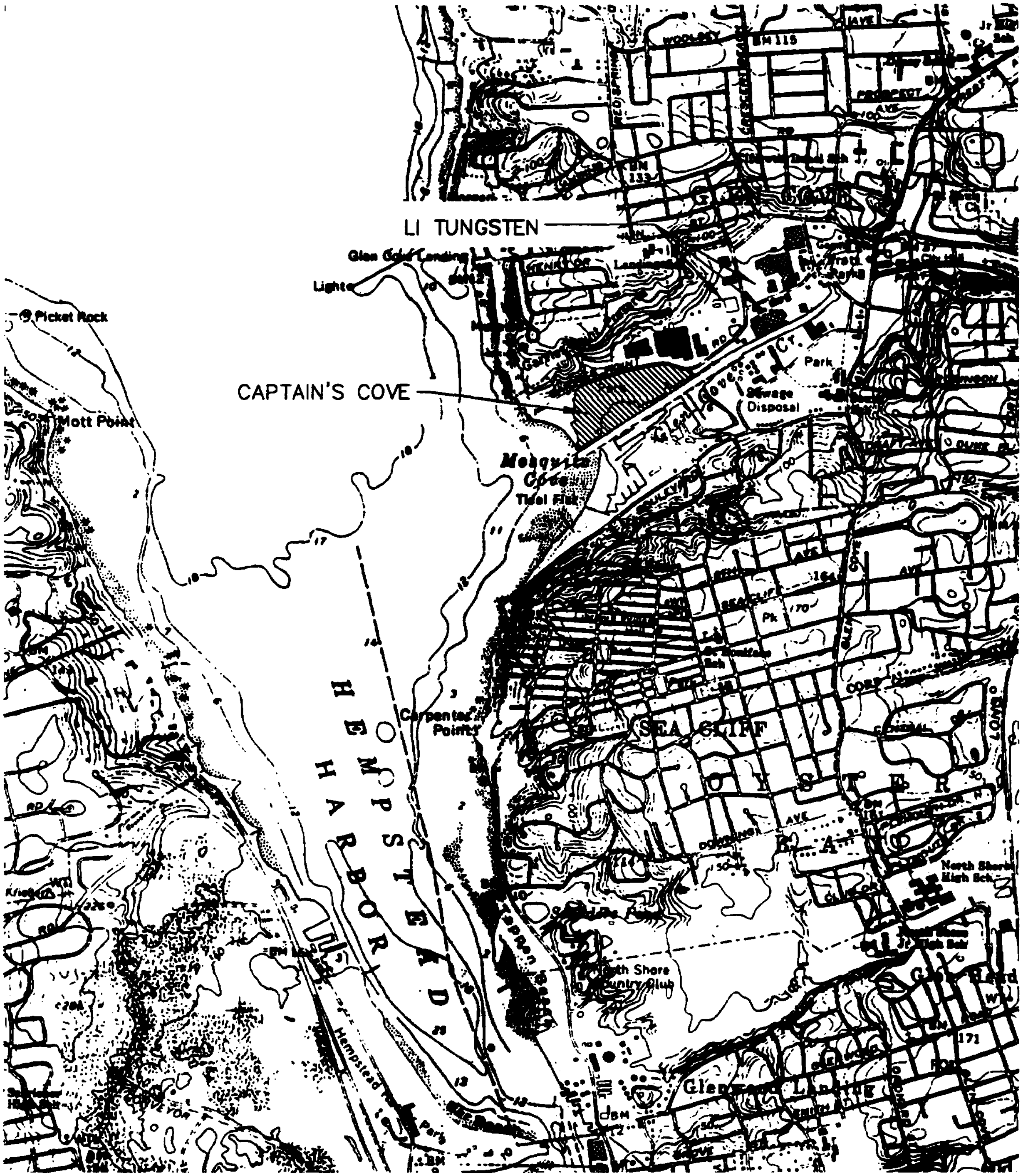
CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L



TITLE: SITE LOCATION MAP

DATE: NOV. 1997

FIGURE NO.: FIGURE 2-2

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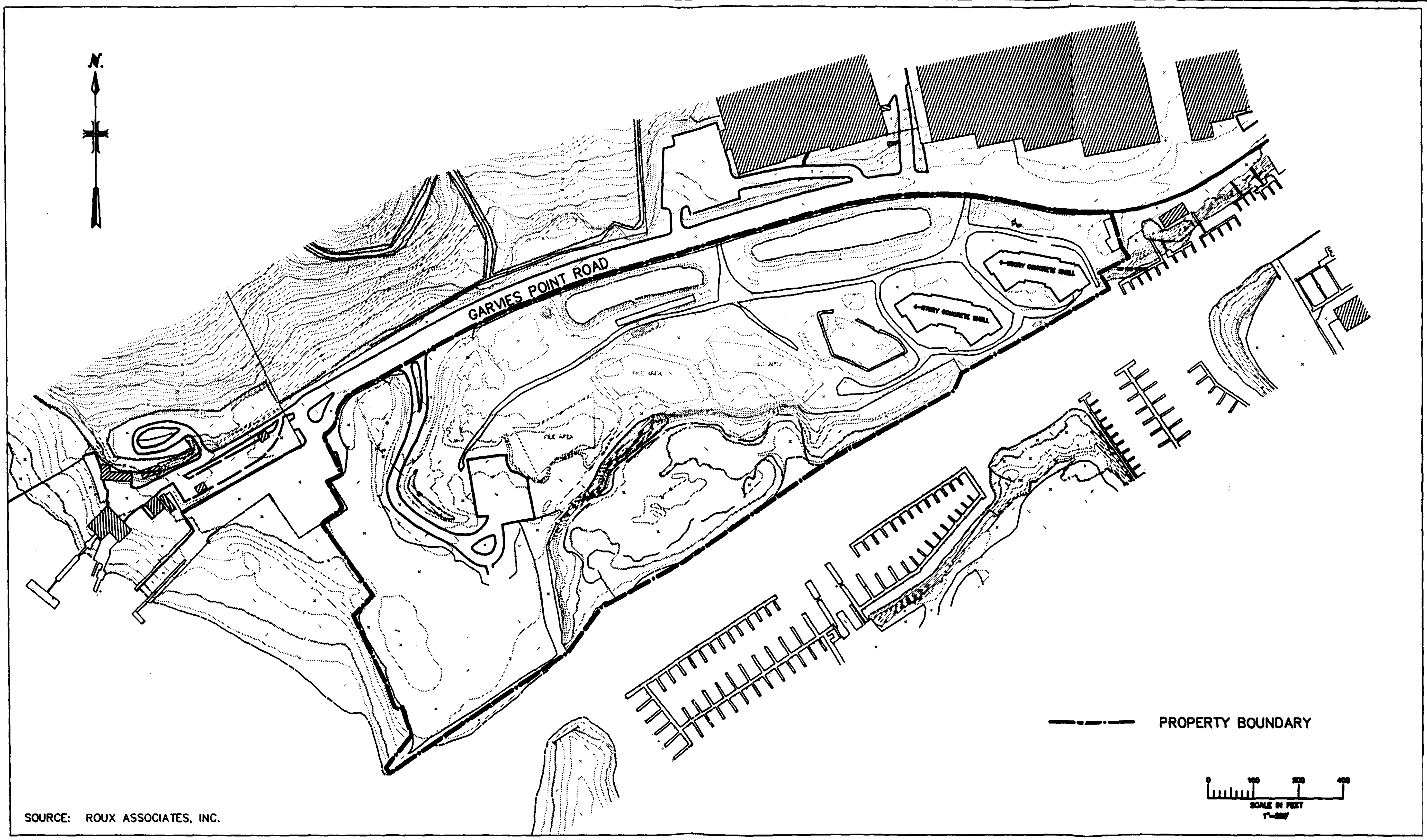
CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L



SOURCE: ROUX ASSOCIATES, INC.

MALCOLM PIRNIE		TITLE: SITE PLAN	CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY GLEN COVE, NEW YORK USEPA REGION II ARCS CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L DATE: NOV. 1997	PROJECT NO.: 8001202 FIGURE NO.: FIGURE 2-3

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The Site was sold by the City of Glen Cove to Village Green Realty in 1983 for development as a condominium complex. The shell of two condominium buildings and the foundation of a third building were completed before the discovery of radiological contamination led to suspension of further development. After subsequent site investigations and the discovery of various non-radiological contamination, the Site was designated as a NYSDEC listed Class 2 inactive hazardous waste site. Additionally, during this period, the radiological contamination was linked to the Li Tungsten site (Ebasco, 1995).

2.3 CURRENT CONDITIONS

After the Site was purchased by Village Green Realty, bulkheads were built along Glen Cove Creek and the western boundary of the Site bordering Hempstead Harbor. The area behind the bulkhead was backfilled with clean fill. Approximately two-thirds of the waterfront along Glen Cove Creek does not feature a bulkhead to preserve an estuarine habitat. A stockade and chain link fence exists along the northern and western site boundaries. Two unlined retention ponds were also constructed near Garvies Point Road to collect surface runoff and allow solids to settle out before the water is released to Glen Cove Creek. Large piles of liner material are stacked near the retention ponds, however, there is no evidence that the liners were ever installed. The liners were intended to prevent infiltration of storm water into the subsurface landfill materials.

Wooden and concrete piles have been driven into the subsurface over much of the Site. The purpose of the piles was to provide structural support to additional planned condominium buildings. Vegetation consists mainly of grasses and weeds with are being replaced along the perimeter of the Site with deciduous trees. Structures on the Site include the burned remains of the former sales office building, the two poured concrete condominium shells, and the poured foundation of a third condominium. In addition, there is an access road to the former sales office building, a parking lot, and two retention ponds along Garvies Point Road. Construction materials (e.g., concrete pipe, reinforcing rod, door frames), piles of trash, fill and landscaping gravel can also be found on the Site.

3.0 INITIAL EVALUATION

3.1 REVIEW OF EXISTING DATABASE

3.1.1 Topography and Drainage

Long Island is located in the Atlantic Coastal Plain Physiographic Province, however, the predominant morphologic characteristics of the region are glacial rather than coastal origin. The area north of the Site is characterized by headlands which rise abruptly from Long Island Sound to an altitude of about 100 to 150 feet above mean sea level (MSL). Southward, the headlands become increasingly irregular, and are dissected by small streams draining into Hempstead Harbor. Individual hills in this area on the Harbor Hill terminal moraine rise to altitudes above 200 feet.

The Site is located within the 100-year floodplain of Glen Cove Creek. Glen Cove Creek, which borders the Site to the south, is a saltwater, tidal channel. Surface water originates on the Site as precipitation and as overland flow from adjacent properties. Surface water runoff from the Site discharges into the creek through the portion of the Site with no bulkhead. Glen Cove Creek is tidally influenced to approximately 0.75 miles upstream from the Site at a gauging station operated by the United States Geological Survey (USGS). A dam is located at the gauging station which prevents the tidal flow. Cedar Swamp Creek, which discharges to Glen Cove Creek approximately one mile east of the Site, had an average annual discharge of 7.40 cubic feet per second between 1938 and 1955. Most ponds and creeks in the area contain fresh water, however, tides may bring seawater into the lower reaches of some streams making the water brackish.

3.1.2 Climate

Long Island, New York is located between 40° and 42° north latitude in a temperate climate belt. Long Island is characterized by a medium temperature range and mild winters that are moderated by the Atlantic Ocean. The mean annual temperature is 54.7° Fahrenheit. The maximum and minimum mean annual temperatures are 76.8° Fahrenheit (July) and 33.6°

Fahrenheit (January) respectively. Precipitation totals are almost the same in the cool season as in the warm season. Most of the precipitation in the area is in the form of rain; only 5 to 10 percent falls as snow or sleet. The mean annual precipitation is 44.22 inches. Monthly averages range from 3.09 inches in February to 5.08 inches in August. The predominant wind flow is from the west-northwest at a mean velocity of 12.4 mph (NOAA, 1974).

3.1.3 Geology

3.1.3.1 Regional Geology

The geology of northwestern Long Island is discussed below with particular emphasis on the Glen Cove region. The Glen Cove region for the purpose of this discussion is defined as the area surrounding the Site for a distance of approximately one mile to the north, east and south, and bounded by Hempstead Harbor to the west. The information was obtained from several USGS publications (Swarzenski, 1963; Kilburn and Krulikas, 1987; Smolensky et. al., 1989; USGS, 1946).

Long Island is the northern most extension of the Atlantic Coastal Plain. The Island is composed of terrestrial deposits of Cretaceous age and Quaternary deposits primarily of glacial origin (Pleistocene). These deposits form a southeastward thickening wedge of sediments which overlie Paleozoic and Precambrian crystalline bedrock. The bedrock surface and the overlying strata generally dip to the southeast, with the unconsolidated strata thickening in the down-dip direction. In the Glen Cove region, the unconsolidated sediments are 400 to 600 feet thick. The stratigraphic column underlying the northern part of the Town of Oyster Bay, Long Island, which includes the Glen Cove region is presented in Table 3-1.

The Site is located about four miles north of the Harbor Hill terminal moraine, a series of coalescing irregular hills (kames) which form a pronounced ridge trending north-northeast across Long Island. This moraine marks the terminal position of the most recent Pleistocene (late Wisconsin) ice sheet to reach Long Island. The deposits which formed during the glacial recession include outwash sand and gravel deposits, till or ground moraine (a heterogenous mixture of clay, silt, sand and boulders) interlayered with gray clay lenses and delta deposits. Earlier glacial deposits associated with the Ronkonkoma glaciation underlie

Table 3-1

Summary of Geology and Water-Bearing Properties of Deposits Underlying the Northern Part of Town of Oyster Bay, Nassau County, New York *

Series	Geologic Unit	Hydrogeologic Unit	Approximate Range in Thickness (ft)	Character of deposits forming geologic unit *(modified from Swarzenski, 1963, and Isbister, 1966)	Water Bearing Properties
QUATERNARY					
Holocene	Undifferentiated artificial fill, salt-march and swamp deposits, stream alluvium, and shore deposits	Upper Glacial Aquifer	0 to 50	Sand, gravel, silt, and clay; organic mud, peat, loam, and shells. Colors are gray, green, black, and brown.	Permeable zones near the shore and in stream valleys may yield small quantities of fresh or brackish water at shallow depths. Clay and silt beneath the north-shore harbors retard saltwater encroachment and confine underlying aquifers.
Pleistocene	Upper Pleistocene deposits		10 to 380	Till, composed of unsorted clay, sand, gravel, and boulders. Outwash deposits of stratified brown sand and gravel. May also contains some lucustrine and marine deposits consisting of clay, silt, and sand; locally fossiliferous.	Till, relatively impermeable, may cause local conditions of perched water and impede downward percolation of precipitation. Outwash deposits of sand and gravel are highly permeable. Wells screened in glacial outwash deposits yield as much as 1,750 gal/min. Specific capacities of large-capacity wells range from 14 to 175 (gal/min)/ft of drawdown. Water is generally fresh and unconfined but may locally contain saltwater near shores.
CRETACEOUS - QUATERNARY					
Upper Cretaceous, Pleistocene, and Holocene	Deposits of Holocene and Pleistocene age, undifferentiated. May locally include eroded remnants of the clay member of the Raritan Formation	Port Washington Confining Unit	0 to 360	Clay, solid and silty, gray, gray-green, white, red, mottled, and brown, containing lenses or layers of sand or sand and gravel. May locally contain lignite, shells, foraminifera, and other microfossils.	Relatively impermeable throughout much of the area. May be moderately to highly permeable in areas adjacent to inferred limit of Magothy aquifer where sand and sand and gravel content may be large. Confines water in underlying Port Washington and Lloyd aquifers but does not prevent movement of water between upper glacial aquifer and Port Washington aquifer. Lenses of sand and sand and gravel provide sources of water with adjacent formations. One large capacity well had a reported yield of 2,000 gal/min with a specific capacity of 43 (gal/min)/ft of drawdown. Coarser deposits may locally contain saltwater near shores.
	Deposits of Pleistocene age, undifferentiated, and/or local errosal remnants of the Lloyd sand member of the Raritan Formation	Port Washington Aquifer	0 to 170	Sand, fine to coarse, white, yellow, gray, and brown, or gray and gravel with interbedded clay, silt and sandy clay	Moderately to highly permeable. One large capacity well had a reported yield of 1,100 gal/min with a specific capacity of 11 (gal/min)/ft of drawdown. Water is confined under artesian pressure. Generally contains freshwater but may have high iron content.
CRETACEOUS					
Upper Cretaceous	Matawan Group Magothy Formation Undifferentiated	Magothy Aquifer	0 to 610	Clay, silt, sand, and sand, fine to medium, clayey, white, gray, yellow, pink, and multicolored, in lenticular beds. May contain lenticular beds of coarse sand and gravel in lower part of unit. Lignite, pyrite and iron oxide concretions may occur throughout the unit.	Moderately to highly permeable. Wells screened in lower part of aquifer yield as much as 1,400 gal/min. Specific capacities of large capacity wells commonly range from 10 to 50 (gal/min)/ft of drawdown but may be as high as 80 (gal/min)/ft. Aquifer is principal source for public supply. Water is generally of excellent quality. Degree of confinement under artesian pressure is variable; however, artesian conditions increase with depth. Hydraulic continuity may exist between the Magothy aquifer and continuous Pleistocene aquifers.
	Clay Member (Raritan Formation)	Raritan Clay Confining Unit	0 to 185	Clay, solid and silty, gray, white, red and mottled. May contain lenses or layers of fine to medium sand which may locally contain gravel. Sand layers frequently occur near top of unit. Lignite and pyrite are common	Relatively impermeable. Confines water in underlying Lloyd aquifer but does not prevent movement of water between Magothy and Lloyd aquifers.
	Lloyd Sand Member (Raritan Formation)	Lloyd Aquifer	0 to 195	Sand, fine to coarse, white, yellow, or gray, and gravel, commonly in a clayey matrix. Contains lenses and layers of solid or silty clay. Beds are usually lenticular and frequently show great lateral changes in composition	Moderately permeable. Large-capacity wells may yield as much as 1,600 gal/min; specific capacities commonly range from 10 to 19 (gal/min)/ft of drawdown. Water is confined under artesian pressure; some wells flow. Water is generally of excellent quality but may have high iron content.
	Crystalline Rocks	Bedrock	Not Known	Metamorphic and igneous rocks; muscovite-biotite schist, gneiss, and granite. May have weathered zone at top.	Relatively impermeable. Contains some water in fractures but impracticable to develop owing to low permeability.

the Harbor Hill drift. These deposits are collectively designated as the upper Pleistocene deposits. Older inter-glacial deposits include lacustrine, estuarine and marine sediments.

The predominant surficial deposit in the Glen Cove region is a veneer of Harbor Hill ground moraine, which is a heterogeneous mixture of clay, silt, sand and boulders typically 5 to 10 feet thick although locally, the thickness is as much as 40 feet. Beneath the ground moraine lies another sequence of older (Ronkonkoma) drift containing interlayered glacial till and outwash deposits. The glacial sediments range in thickness from less than 10 to over 200 feet in the northern part of Long Island (Kilburn and Krulikas, 1987).

On most of Long Island, the glacial deposits lie unconformably on the Mattawan Group (Magothy Formation - undifferentiated), a Cretaceous age sedimentary sequence of sand, gravel and discontinuous clay lenses. In the Glen Cove region, however, the Magothy Formation is missing. The absence of the Magothy is attributed to channel cutting during a pre-Wisconsin stage of the Pleistocene epoch (Smolensky et al., 1989). Post Cretaceous erosion was the major contributing factor in producing more than 400 feet of relief on the Cretaceous surface along the north shore of Long Island.

In the Glen Cove region the upper Pleistocene deposits are underlain by an extensive unit comprised of clay, silt and a few layers of sand. This unit is believed by some researchers to be equivalent to the Gardiners Clay, which is a shallow marine sequence deposited during an interglacial period (Swarzenski, 1963; Isbister, 1966). A more recent publication (Kilburn, 1972) refers to this stratum as the Port Washington confining unit and identifies it as Pleistocene and Holocene age.

In the Glen Cove region, that sequence rests unconformably on the unnamed clay member of the Raritan Formation. The surface of the clay member is about 200 feet below sea level (Smolensky et al., 1989). The clay member and the Pleistocene clay deposits are in direct contact and differentiation between the two is sometimes difficult (Smolensky, 1989). Together these strata comprise a contiguous unit approximately 75 feet thick in the Glen Cove region.

The lower unit of the Raritan Formation is the Lloyd Sand Member which is approximately 125 feet thick in the Glen Cove region. The Lloyd Sand Member rests on bedrock at depths of approximately 400 to 500 feet below MSL (Smolensky e. al., 1989).

3.1.3.2 Site Geology

A review of aerial photographs dating from 1950 through 1989 have shown that most of the Site has been landfilled (RTP, 1988). Test pit excavations performed in 1990 (Hart, 1990) indicate variable depths of fill across the Site. The fill was thinnest near the northern (3.5 feet) and western (0 feet) portions of the Site and thickest on the eastern portion of the Site near the former area of the tidal embayment (16 feet). Native soils encountered at the Site consisted of a reddish-brown medium grained sand with gravel. The nature of the fill materials was consistent across the Site and included various types of debris (e.g., plastic bags, wood, brick, glass, metal, tires, concrete and paper). Soils on the eastern site boundary consisted of sandy soil with minor amounts of debris.

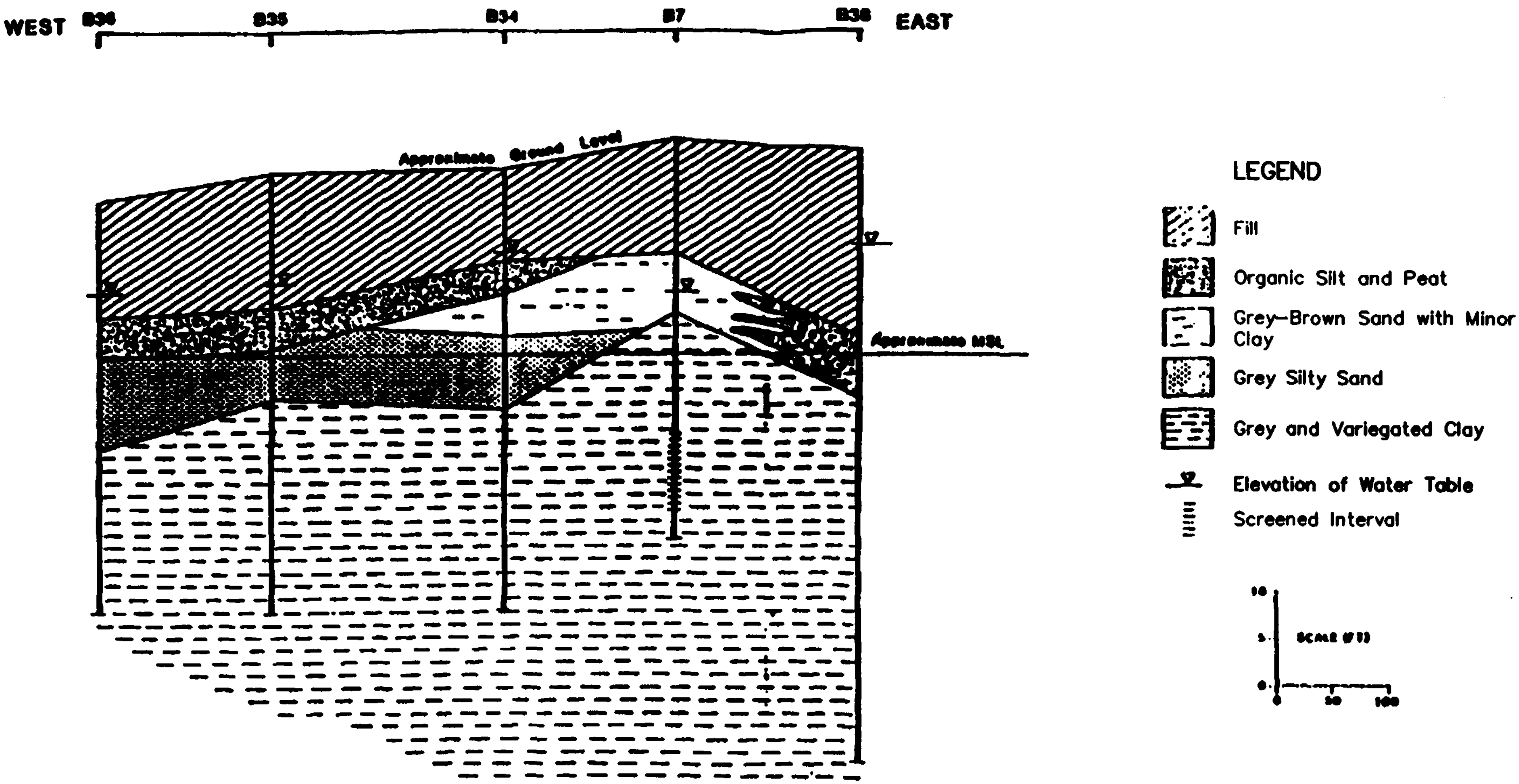
Geologic cross-sections constructed from boring logs drilled in 1976 and 1980 described in an earlier RI/FS work plan (Hart, 1989a) indicate a veneer of fill deposits across the Site varying from 8 to 22 feet thick. Underlying the fill across most of the Site is a thick clay unit. The geologic cross-sections are presented in Figures 3-1 and 3-2.

3.1.4 Hydrogeology

3.1.4.2 Regional Hydrogeology

There are two discrete aquifers in the Glen Cove region. These are designated as the Upper Glacial and the Lloyd aquifers. In addition to these aquifers, local bodies of perched groundwater occur above the water table. Nassau and Suffolk Counties were declared a sole source aquifer by USEPA on June 29, 1978.

Bodies of perched groundwater are found in several parts of the Glen Cove region. Perched groundwater occurs where the downward migration of water in the vadose zone is impeded by a layer of relatively low permeability which results in a local zone of saturation above and unrelated to the main water table. In the Glen Cove region, perched water occurs close to



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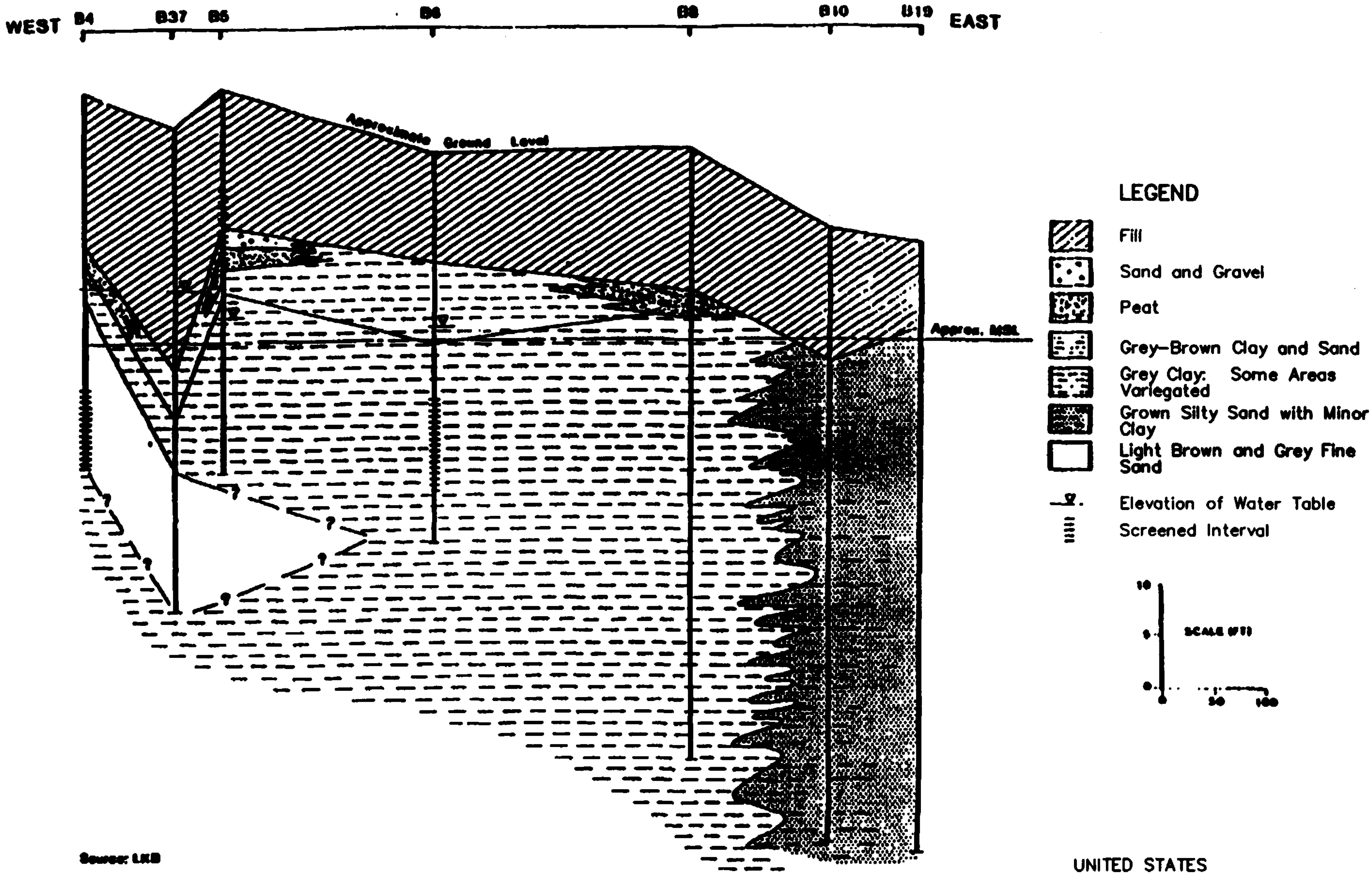
UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION II

CAPTAIN'S COVE SITE
GLEN COVE, NY

GEOLOGIC SECTION ALONG
NORTHERN PORTION OF THE SITE

FIGURE 3-1



SOURCE: FRED C. HART ASSOCIATES, INC.

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION II

CAPTAIN'S COVE SITE
GLEN COVE, NY

GEOLOGIC SECTION ALONG
CENTRAL PORTION OF THE SITE

FIGURE 3-2

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the land surface in depressions that are underlain by clayey till and clay. Perched groundwater is prevalent in the area of ground moraine north of the Harbor Hill terminal moraine (which includes the Glen Cove region).

The Upper Glacial aquifer consists of permeable upper Pleistocene deposits that occur below the water table. The water table occurs from MSL to about 60 feet above MSL in the Glen Cove region. Recharge is entirely from precipitation occurring mostly during the late fall and winter when plant growth is dormant. Under natural conditions, shallow groundwater discharges to streams, springs and Long Island Sound and its harbors by evapotranspiration and by downward leakage to the underlying aquifer. Previous investigations have indicated that groundwater movement in the Upper Glacial aquifer is generally to the south in the vicinity of the Site, with shallow discharge to Glen Cove Creek. Groundwater movement in the deeper aquifers may pass under the creek. In the Glen Cove region, discontinuous beds of low permeability sediments limit the amount of water which can be pumped from the Upper Glacial aquifer and several wells tap the deeper Lloyd aquifer.

The Magothy aquifer is not present in the Glen Cove region. However, groundwater undoubtedly moves into the Upper Glacial aquifer where it is in contact with the subcrop of the Magothy formation to the west and south.

The clay member of the Raritan Formation is a confining unit that overlies the Lloyd aquifer. The Port Washington confining unit occurs above, and is contiguous with, the clay member in many places. Together, these strata form an effective confining unit separating the Lloyd aquifer from the Upper Glacial aquifer in the Glen Cove region. The thickness of the confining unit is about 112 feet at the Li Tungsten site based on the log of well N1917. In places where the Cretaceous deposits have been completely eroded, the Port Washington confining unit lies on a sequence of deposits of Pleistocene and (or) Late Cretaceous Age called the Port Washington aquifer. It is not known if the Port Washington aquifer extends onto the Site.

The lower limit of the Lloyd aquifer and the Port Washington aquifer is the Precambrian bedrock surface; the upper limit is the clay member of the Raritan formation or the Port Washington confining unit. The Lloyd aquifer is the most confined of the water bearing units, as demonstrated by minimal interference effects between pumping wells tapping the different aquifers. Hydraulic heads in the Lloyd aquifer are generally lower than those in the Upper Glacial aquifer resulting in downward leakage of water through the clay unit. The Lloyd aquifer is replenished entirely by downward percolation of water from the overlying aquifers through the more permeable zones of the confining unit and, directly but slowly, through the clay itself. The primary recharge area of the Lloyd aquifer is in eastern Nassau County. Groundwater movement in the Lloyd aquifer is generally westward, away from the recharge area. Groundwater moves laterally into the Port Washington aquifer from the Lloyd aquifer where the two units are contiguous. Water discharges by submarine leakage and through pumping wells.

3.1.4.2 Site Hydrogeology

There are four existing monitoring wells on Site from a previous site investigation (CDM, 1985). Three wells are screened from 12 to 22 feet below ground surface and one well is screened from three to 12 feet below ground surface. Water level measurements, generally less than 15 feet below ground surface, indicate that shallow groundwater beneath the Site flows southeasterly, toward Glen Cove Creek.

3.1.5 Population and Environmental Resources

Population, Land Use and Zoning - Glen Cove is located on the north shore of Long Island, in a suburban area with an economically and ethnically mixed population. As of 1990, Glen Cove's population totaled 24,149 (U.S. Dept. of Commerce, 1990). Glen Cove's population is predominantly white (86%) with African-American (8%), Asian (3%), Hispanic and other racial and ethnic groups (3%) also represented. Approximately 4% of the residents are children under the age of three, and 17% are senior citizens over the age of 64 (U.S. Dept. of Commerce, 1990). Glen Cove's economic base ranges from very wealthy to very poor, with a substantial middle class (Ebasco, 1991).

The area within a 1.5 mile radius of the Site contains a community hospital, eight schools, 11 municipal parks, as well as Garvies Point Preserve. Seven of these parks and one school are in Sea Cliff, the others are found in Glen Cove (Ebasco, 1991). The area that surrounds the Site is predominantly industrial. The Site is located in an area zoned as I-2, Light Industrial District (the area west of Dickson Lane which lies north of Herb Hill Road) and I-3, Industrial District (the areas east of Dickson Lane and south of Herb Hill Road). The surrounding areas consist of both industrial and residential zoning districts, the closest residential areas falling into the R-1, R-3 and R-4 districts. R-1 zoning consists of one acre residences, R-3 zoning consists of quarter acre residences and R-4 zoning is comprised of 6,500 - 7,500 square foot, one and two family residences.

Environmental Resources - Glen Cove Creek forms the southern boundary of the Site and empties into Hempstead Harbor at the southwestern periphery of the Site. There is an estuarine emergent wetland located on the Site along Glen Cove Creek. The wetland, as measured from a National Wetlands Inventory Map, has approximately 0.2 miles of frontage on Glen Cove Creek. There was a soil berm along the southern border of the Site along the creek during landfilling operations. After the property was purchased for the development of condominiums in 1980, bulkheads were built along approximately two-thirds of the frontage on Glen Cove Creek, and the landfilled area was regraded. The wetlands located along the bank of Glen Cove Creek adjacent to the Site was not bulkheaded to preserve the habitat.

Most streams in the area flow north toward the Sound and are less than three miles long. Stream flow is primarily composed of groundwater discharge. Cedar Swamp Creek, which generally flows to the south, had an annual discharge of 7.40 cubic feet per second where it flows into Glen Cove Creek for the period 1938 to 1955. Most ponds and creeks in the area contain fresh water (less than 30 ppm chloride). Tides may bring seawater into the lower reaches of some streams and make the water brackish. The temperature of the stream waters are in rough agreement with monthly mean air temperatures.

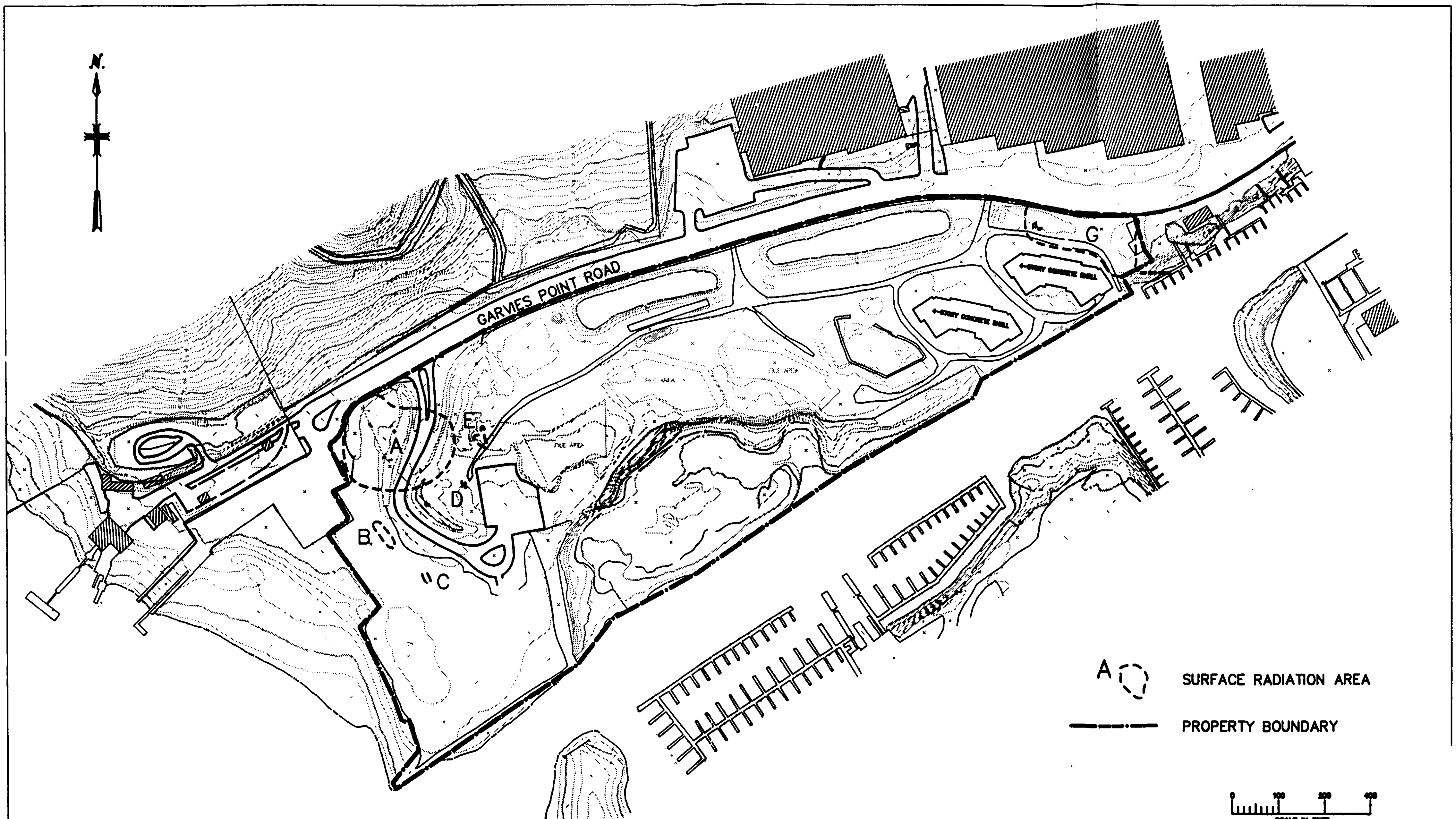
3.1.6 Characteristics of Radiological Contamination

It has been reported by a former site worker that the Li Tungsten Corporation periodically disposed of ore residues on the Captains Cove property. No records exist of these alleged activities, and no quantitative information related to waste volumes, activity concentrations, or exposure rates have been discovered.

The NYSDEC Radiation Program conducted a surficial radiation survey of the Site (NYSDEC, 1997). The survey confirmed results of an earlier survey (HART, 1989) and showed that surficial contamination is primarily concentrated in two areas of the Site as shown on Figure 3-3. The two main areas are at the northwest corner (designated Area A by NYSDEC) and at the far eastern end near the east condominium shell (designated Area G by the NYSDEC). It also appears that smaller areas of contamination (designated Areas B, D and E by the NYSDEC) have resulted possibly from surface water runoff and landscaping activities. Soil sample results show varying concentrations of thorium, uranium, and radium and their associated decay products in areas of elevated meter readings. In general, uranium and thorium series radionuclide concentrations ranged from 1-50 pCi/g; one apparently anomalously high activity sample collected from 4-6 feet below the surface was reported to have 583 pCi/g natural thorium, 662 pCi/g natural uranium, and 772 pCi/g ^{226}Ra.

3.2 PRELIMINARY IDENTIFICATION OF APPLICABLE AND RELEVANT AND APPROPRIATE REQUIREMENTS (ARARs)

Section 121(d)(2)(A) of CERCLA incorporates into law the CERCLA Compliance Policy, which specifies that Superfund remedial actions meet any federal standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate requirements (ARARs). State ARARs must be met if they are more stringent than federal requirements. Furthermore, Section 121 requires the selection of a remedial action that is protective of human health and the environment. Determining protectiveness involves a risk assessment in accordance with CERCLA guidance.



SOURCE: ROUX ASSOCIATES, INC.

MALCOLM PIRNIE	UNITED STATES ENVIRONMENTAL PROTECTION AGENCY	TITLE: SURFACE RADIOLOGICAL SURVEY RESULTS	CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY GLEN COVE, NEW YORK USEPA REGION II ARCS CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L DATE: NOV. 1997	PROJECT NO.: 8001202 FIGURE NO.: FIGURE 3-3

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To Be Considered Material (TBCs) are non-promulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. As described below, TBCs will be considered along with ARARs as part of the Baseline Risk Assessment Baseline Risk Assessment and may be used in determining the necessary level of cleanup for protection of health and the environment.

ARARs (and TBCs necessary for protection) must be attained for hazardous substances, pollutants, or contaminants remaining on-site at the completion of the remedial action, unless waiver of an ARAR is justified. In addition, the USEPA intends that the implementation of remedial actions should also comply with ARARs (and TBCs as appropriate) to protect public health and the environment. ARARs (and TBCs necessary for protection), pertaining both to contaminant levels and to performance or design standards, should generally be attained at all points of potential exposure, or at the point specified by the ARAR itself.

This section of the Draft Final Work Plan provides a *preliminary* determination of the federal and state environmental and public health requirements that are potential ARARs and TBCs for this Site. The information in this section is based upon CERCLA Compliance with Other Laws Manual: Interim Final (USEPA, 1988a), CERCLA Compliance with Other Laws Manual: Part II. Clean Air Act and Other Environmental and State Requirements (USEPA, 1989c), and USEPA's Generic Work Plan (USEPA, 1989b).

3.2.1 Definition of ARARs

General

A requirement under other environmental laws may be either "applicable" or "relevant and appropriate," but not both. Identification of ARARs must be done on a site-specific basis and involves a two-part analysis: first, a determination whether a given requirement is applicable; then if it is not applicable, a determination whether it is nevertheless both relevant and appropriate.

Applicable Requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site.

Relevant and Appropriate Requirements are those cleanup standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site.

Three classifications of ARARs have been established and include:

- Chemical-Specific - Usually health or risk-based numerical values or methodologies which, when applied to site-specific conditions, result in the establishment of numerical values. These values establish the acceptable amount or concentration of a chemical that may be found in, or discharged to, the ambient environment;

- Location-Specific - Restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations; and

- Action-Specific - Usually technology or activity-based requirements or limitations on actions taken with respect to hazardous wastes.

3.2.2 Consideration of ARARs During the FFS

ARARs will be considered at the following intervals during the FFS process:

- Scoping of the FFS. Identify chemical-specific and location-specific ARARs on a preliminary basis, in order to plan the site characterization sampling locations, and analytical Data Quality Objectives (DQOs) (including any required non-RAS laboratory analysis).

- Site characterization and Baseline Risk Assessment phases of the FFS. Identify the chemical-specific ARARs and TBCs and location-specific ARARs more comprehensively and use them to help determine the cleanup goals.

- Development of remedial alternatives in the FFS Report. Identify action-specific ARARs for each of the proposed alternatives and consider them along with other ARARs and TBCs.

- Detailed evaluation of alternatives. Examine all the ARARs and TBCs for each alternative as a package to determine what is needed to comply with laws and regulations and whether or not compliance is expected.

- Selection of remedy. Select an alternative able to attain all ARARs, unless one of the six statutory waivers is invoked.

- Remedial design. Ensure that the technical specifications of remedy construction attain ARARs.

As the FFS progresses, the list of ARARs will be continually updated. ARARs will be used as a guide to establish the sampling strategy and the appropriate extent of site cleanup; to aid in scoping, formulating and selecting proposed treatment technologies; and to govern the implementation/operation of the selected action. Primary consideration will be given to remedial alternatives that attain or exceed the requirements found in the ARARs. At each interval, ARARs are identified and utilized by taking into account the following:

- Contaminants suspected to be at the Site
- Chemical/radiochemical analyses to be performed
- Types of media to be sampled
- Geology and other Site characteristics
- Use of the resource/medium
- Level of exposure and risk
- Potential transport mechanism
- Purpose and application of the potential ARARs
- Remedial alternatives that will be considered for the Site

3.2.3 Preliminary Identification of Potential Radioactivity ARARs and TBCs

Public health standards and guidelines for ionizing radiation are concerned with protecting individuals and future generations from unnecessary exposures. Standards addressing occupational exposure limits (such as those promulgated by the USEPA and the NRC and discussed below) mandate the reduction of all exposures to levels that are as low as reasonably achievable (ALARA), in consideration of technical, economic, and social factors. These occupational standards are TBCs and will be adhered to during any future remedial activities.

The radionuclides uranium and thorium and their decay products (which include radium and radon) are listed as hazardous substances under CERCLA in 40 CFR 302.4 because they are classified as hazardous substances under Section 112 of the Clean Air Act.

Regulatory responsibilities for radiation protection are shared by the USEPA, NRC, Occupational Safety and Health Administration (OSHA), United States Department of Energy (DOE), United States Department of Transportation (DOT), and agencies within the 50 State governments. In some cases, regulations incorporate the recommendations of organizations such as the International Commission on Radiological Protection (ICRP), the National Council on Radiation Protection and Measurements (NCRP), and the Committee on the Biological Effects of Ionizing Radiation (BEIR) of the National Academy of Sciences (NAS).

Three types of contaminant-specific ARARs and TBCs are described below. (1) Exposure limits regulate the acceptable amounts of whole body dose equivalent to members of the general public and to workers at commercial facilities which utilize radioactive materials. (2) Radon and radon decay product ARARs limit the concentration of radon gas and radon decay products inside homes and buildings. (3) ARARs addressing specific radionuclides, such as thorium, have been promulgated to limit the concentration of radionuclides in soil. Surface contamination levels have been set quantifying the quantity of total and removable radioactivity allowable on materials released for unrestricted use by members of the general public.

Exposure Based

The U.S. Atomic Energy Act (AEA) of 1954 granted the Federal Radiation Council (FRC) the authority to establish generally applicable environmental standards for exposure to radiation and radioactive materials. In 1970, the functions of the FRC were transferred to the USEPA. Since that time, the USEPA has revised the existing federal guidance for the control of occupational radiation hazards several times. In Federal Guidance Report No. 11 (USEPA, 1988c), a TBC for this project, an occupational dose equivalent limit of 5 rem per year for public sector workers is established.

In the past, USEPA has identified the concentration-based standards established in 40 CFR 192, *Health and Environmental Protection Standards For Uranium And Thorium Mill Tailings*, as being relevant and appropriate at CERCLA sites containing wastes similar to those present at the Captains Cove site. However, USEPA has recently adopted a policy of establishing dose-based guidance for limiting the risk to the general public from exposure to residual radioactivity. OSWER Directive No. 9200.4-18, *Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination* advises USEPA staff that an effective dose equivalent of 15 millirem per year (mrem/yr) above background would reduce the lifetime risk level to approximately 3×10^{-4}, which is a level generally considered protective and consistent with the risk reduction objectives of the National Oil and Hazardous Substances Pollution Contingency Plan (USEPA, 1997). Since annual dose equivalent (from all pathways) cannot be directly measured, dose assessment models must be utilized to relate medium-specific radionuclides of concern to annual dose under a defined, appropriate land use scenario.

NRC has the authority to set regulations governing occupational radiation exposure in the private sector. In 10 CFR 20, Standards for Protection Against Radiation, a 5 rem per year occupational dose equivalent limit has been set for radiation workers. The dose equivalent limit from all pathways for members of the general public has been established at 100 mrem per year due to the licensed operations, which is compatible with that recommended by the ICRP (ICRP, 1990). The 100 mrem standard pertains to releases from an active licensee; it is not intended as a standard for remediation of a formerly licensed site. In that situation, the total effective dose equivalent to the most highly exposed member of the public is established in the USNRC *Radiological Criteria for License Termination, Final Rule*, which was published in the Federal Register on July 21, 1997. It requires that the dose following decommissioning of a formerly licensed facility should not exceed 25 mrem per year (USNRC, 1997). The dose must also be shown to be ALARA. The NRC rule would not be considered an ARAR or TBC at the Captains Cove site, since USEPA has determined that it is not protective of public health (as reflected in the more restrictive OSWER directive cited above).

NRC has published several guidance documents which provide guidance on decommissioning former radioactive materials licensees. These TBCs include NUREG-1500, Working Draft Regulatory Guide on Release Criteria for Decommissioning: NRC Staff's Draft for Comment (USNRC, 1994) and NUREG/CR-5512, Residual Radioactive Contamination From Decommissioning, Technical Basis for Translating Contamination Levels to Total Effective Dose Equivalent (USNRC, 1992). These detail methodology to develop preliminary remediation goals for surface contamination and medium-specific radionuclide concentrations which are compliant with the 25 mrem per year standard. It should be noted that several related NUREG documents are currently in the process of being revised.

Occupational control of radiation exposure is addressed by OSHA in 29 CFR 1910.120, Hazardous Waste Operations And Emergency Response. Radiation monitoring is required during initial investigations of hazardous waste facilities. Radioactive wastes must not be handled until the hazard to workers is assessed. Exposure limits for workers involved in RI field activities will be listed in the site health and safety plan.

The DOE is responsible for setting standards to protect DOE employees and contractors and the general public from radiation exposures resulting from the use of radioactive materials at DOE facilities. DOE policy has been described in a series of documents, called DOE orders, which are TBCs for this project. In DOE 5480.11, Radiation Protection For Occupational Workers, the occupational limit is set at 5 rem per year (USDOE, 1988). In DOE 5400.5, Radiation Protection of The Public And the Environment, DOE lowered the acceptable dose equivalent to a member of the public from 500 mrem per year to 100 mrem per year (USDOE, 1990), resulting in a limit compatible with that recommended by the ICRP (ICRP, 1990). The standard pertains to the dose equivalent from all DOE activities, including exposures resulting from both routine releases from active facilities and those attributable due to residual radioactivity following remedial actions.

In 1993, the New York State Department of Environmental Conservation has issued Technical Administrative Guidance Memorandum (TAGM) 4003, titled *Cleanup Guideline for Soils Contaminated with Radioactive Materials*. This document established State policy which limits the annual total effective dose equivalent to the maximally exposed member of the general public, to as low as reasonably achievable and less than 10 mrem above background resulting from exposure to residual radioactivity in soils. This guidance is TBC for the Captains Cove site.

Radon and Thoron

Risks due to exposure to radon and radon decay products have been evaluated by the USEPA as well as many other scientific bodies. The USEPA has established indoor exposure guidelines (which are a TBC for this project) in the 1992 Citizen's Guide to Radon (USEPA, 1992a). In addition, 40 CFR 192 provides standards for the control of residual radioactive materials from inactive uranium processing or depository sites which include indoor concentrations of radon and the release of radon to the atmosphere. These guidelines and standards are TBC for future use of buildings on the Captains Cove site.

The USEPA recommends that indoor radon concentrations should not exceed 4 pCi/L. This is a voluntary guideline and, as such, is a TBC. Radon decay products are limited to an average of 0.02 Working Level (WL) (including background) and a maximum of 0.03 WL (including background) in 40 CFR 192. At 50 percent equilibrium between radon and its decay products, a 4 pCi/L radon concentration would result in 0.02 WL of radon decay products. The mill tailings standard also (1) limits the release of radon gas to the atmosphere to a rate of 20 pCi per square meter per second; (2) limits the increase in annual average concentration of ^{222}Rn in air at or above any location outside the disposal site to no more than 0.5 pCi/L; and (3) pertains to ^{220}Rn, or thoron gas, as well as radon.

Concentration Based

There are no directly applicable standards addressing the concentration limits of materials contaminated with naturally occurring radionuclides, even if the radionuclide concentrations in the waste have been enhanced by an industrial process. In 40 CFR 192, however, USEPA established standards for the stabilization, disposal, and control of uranium and thorium mill tailings from both inactive and active designated uranium mill sites. These standards have been cited as being relevant and appropriate at other CERCLA sites in the past, but now are only applicable at uranium mill tailing cites that are exempt from CERCLA (USEPA, 1997).

There are no standards regulating the concentration of radionuclides in building structural materials. A 5 pCi/g limit has been utilized at other CERCLA sites for radium in materials other then soil, but would can no longer be considered a TBC for that element at the Captains Cove site. As with soil contamination, dose modeling should be done (on a site-specific basis) to relate building materials contamination (surface and/or volumetric) to annual dose equivalent.

Remediation of radionuclides in soil will also reduce the risk from ingestion of soil to acceptable levels. There currently are no USEPA guidelines specifying acceptable radionuclide concentrations in soil used to grow food products.

DOE has established soil cleanup guidelines at Formerly Utilized Sites Remedial Action Program (FUSRAP) and Remote Surplus Facilities Management Program (SFMP) Sites for uranium and thorium series radionuclides (USDOE, 1990). These are consistent with the 40 CFR 192 concentrations established for radium and would be TBC for this project.

NRC has set guidelines for decontamination of building surfaces and equipment prior to their release for unrestricted use from facilities licensed to possess radioactive materials (USNRC Regulatory Guide 1.86, 1974 and USNRC Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use of Termination of Licenses for Byproduct, Source, or Special Nuclear Material, 1982). Items with surface radioactivity levels which do not exceed these levels (Table 3-2) do not pose an unacceptable risk of radiation exposure to members of the public. These limits for the radionuclides of concern found on any structural materials and debris found at the Captains Cove site are a TBC; they provide a set of criteria to determine which materials would require decontamination or disposal in a low level radioactive waste disposal facility.

ARARs and TBCs for the site addressing gamma radiation exposure, exposure to radon and radon decay products, radium concentration of soils and building materials, and total effective dose equivalent from all pathways are summarized in Table 3-3.

The ingestion of radionuclides in drinking water has been regulated at the federal level. MCLs have been promulgated by the USEPA in 40 CFR 141.15 and 141.16. These limit the sum of ^{226}Ra and ^{228}Ra to 5 pCi/L, gross alpha activity (excluding radon and uranium isotopes) to 15 pCi/L, and beta/gamma emitters to concentrations resulting in a 4 mrem annual dose equivalent in community water systems. The MCLs are summarized in Table 3-4.

The discharge of radionuclides to air and water is addressed by the State of New York in 6 NYCRR Part 380-11.7 Table II. Release limits for radium, thorium, and uranium are shown in Table 3-5. Limits for release into the sanitary sewer system (NYCRR Part 380-11.7 Table

TABLE 3-2

ACCEPTABLE SURFACE CONTAMINATION LEVELS

NUCLIDES[a]	AVERAGE[b,c,f]	MAXIMUM[b,d,f]	REMOVABLE[b,e,f]
U-nat, U-235, U-238, and associated decay product	5,000 dpm α/100 cm^2	15,000 dpm α/100 cm^2	1,000 dpm α/100 cm^2
Transuranics, Ra-226, Ra-228, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	100 dpm/100 cm^2	300 dpm/100 cm^2	20 dpm/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	1000 dpm/100 cm^2	3000 dpm/100 cm^2	200 dpm/100 cm^2
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and others noted above	5000 dpm ß /100 cm^2	15000 dpm ß /100 cm^2	1000 dpm ß /100 cm^2

a. Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma emitting nuclides should apply independently.

b. As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

c. Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

d. The maximum contamination level applies to an area of not more than 100 cm^2.

e. The amount or removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

f. The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/h at 1 cm and 1.0 mrad/h at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

Source: USNRC, 1982. Guidelines for Decontamination of Facilities and Equipment Prior to Release for Unrestricted Use or Termination of Licenses for Byproduct, Source, or Special Nuclear Material.

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TABLE 3-3

IONIZING RADIATION CONTAMINANT-SPECIFIC ARARs AND TBCs

TYPE	ARAR OR TBC	PERTINENT STANDARD OR GUIDELINE	REFERENCE
Gamma Radiation: Indoor Total	 ARAR TBC	 20 μR/h above bkg. 10 mrem/yr	 40 CFR 192.12(b)(2) NYSDEC TAGM 4003
Radon Indoor Concentration	 TBC	 4 pCi/L	 EPA 1992
Radon Decay Progeny: Average Maximum	 ARAR ARAR	 0.02 WL 0.03 WL	 40 CFR 192.12(b)(1) 40 CFR 192.12(b)(1)
Soil: Radium Other Radionuclides[1]	 ARAR --	 5 pCi/g --	 40 CFR 192.12(a) --
Bldg. Materials: Radium Other Radionuclides[1]	 TBC --	 5 pCi/g --	 40 CFR 192 --
All Pathways[2]	ARAR	15 mrem/yr	OSWER No. 9200.4-18

[1] Radionuclide-specific TBCs may be calculated using the methodology provided in NUREG/CR-5512 (NRC, 1994), the RESRAD computer code, or other model to attain compliance with the 15 mrem/yr post-remediation TBC.

[2] Total committed effective dose equivalent due to residual radioactivity following site remediation.

TABLE 3-4

MAXIMUM CONTAMINANT LIMITS (MCLs) IN PUBLIC DRINKING WATER SYSTEMS

RADIONUCLIDE	MCL (pCi/L)
Ra-226 & Ra-228	5
Gross Alpha (excluding radon and uranium)	15
Beta/gamma emitters	4*

*Beta/gamma emitters limited to concentrations resulting in a 4 mrem annual dose equivalent.

Source: 10 NYCRR Part 5-1.52; 40 CFR 141.15-.16.

TABLE 3-5

CONCENTRATIONS LIMITS IN AIR AND WATER ABOVE NATURAL BACKGROUND FOR RADIONUCLIDES RELEVANT TO THE CAPTAIN'S COVE SITE

RADIONUCLIDE	AVERAGE CONCENTRATION AIR ($\mu Ci/ml$)	WATER
^{226}Ra	9×10^{-13}	6×10^{-8}
^{228}Ra	2×10^{-12}	6×10^{-8}
^{230}Th	2×10^{-14}	1×10^{-7}
^{232}Th	4×10^{-15}	3×10^{-8}
^{234}U	1×10^{-12}	3×10^{-7}
^{238}U	1×10^{-12}	3×10^{-7}

Source: 6 NYCRR Part 380-11.7 Table II

III) are shown in Table 3-6. Another potential ARAR is NYS ECL Part 382 which contains the regulations of low-level radioactive waste disposal facilities.

Waste Classification/Disposal

NORM is not considered hazardous waste under the Resource Conservation and Recovery Act (RCRA), nor does it fall into any classification categories under the AEA or the Low Level Radioactive Waste Policy Act (LLRWPA).

There are no applicable or relevant and appropriate federal requirements which address disposal of thorium-contaminated soil and other miscellaneous materials with the exception of materials which could be classified as 11(e)(2) waste which is regulated by the USNRC. There are no provisions under 40 CFR 192 which pertain to the disposal of mill tailings from inactive uranium processing sites at locations other than where the mill tailing piles already exist. Disposal of these types of wastes is regulated by states hosting disposal facilities. It is possible that, over the next several years, as more states and regional compacts develop low level radioactive waste disposal facilities, additional facilities will be available to accept diffuse NORM and 11(e)(2) waste. It is also possible, however, that the relatively large volumes of this type of waste will not be accepted at new disposal facilities, which are being developed primarily to provide disposal capacity for radioactive wastes as defined by the Atomic Energy Act.

Prior to disposal, waste material will be analyzed for chemically hazardous materials as defined in RCRA regulations. RCRA disposal requirements are relevant and appropriate to commingled wastes containing both chemical and radioactive materials.

Regulations under 49 CFR 171-173 govern all modes of hazardous materials transportation, including packing, repacking, handling, labeling, marking, placarding, and routing. Key definitions which address DOT regulations concerning radioactive material are:

TABLE 3-6

RELEASE OF RADIONUCLIDES INTO THE SANITARY SEWER SYSTEM

RADIONUCLIDE	MONTHLY AVERAGE ($\mu Ci/ml$)
^{226}Ra	6×10^{-7}
^{228}Ra	6×10^{-7}
^{230}Th	1×10^{-6}
^{232}Th	3×10^{-7}
^{234}U	3×10^{-6}
^{238}U	3×10^{-6}
U-natural*	3×10^{-6}

*In equilibrium with decay products.

Source: 6 NYCRR Part 380-11.7 Table III

- Radioactive material - any material having a specific activity greater than 0.002 μCi/g (49 CFR 171);
- Low Specific Activity (LSA) material - uranium or thorium ores and nonradioactive material externally contaminated with no more than 0.1 μCi per square cm. Specific packing requirements for LSA materials are presented in 49 CFR 173.425. A single shipment must not exceed 2,000 pCi/g for total radioactivity concentration. Packaging exceptions are given in 49 CFR 173.421. Limited quantities of radioactive materials are defined in 49 CFR 173.423. General design packaging requirements are outlined in 49 CFR 173.411-419.

3.3 PRELIMINARY RISK ASSESSMENT

This section presents a preliminary assessment of the potential public health and environmental impacts associated with the Site. It provides the basis for the sampling and analysis programs described in this Draft Final Work Plan. This assessment is based on information gathered to date relating to the distribution and concentrations of contaminants, Site history, land use, demography, hydrogeology and other data.

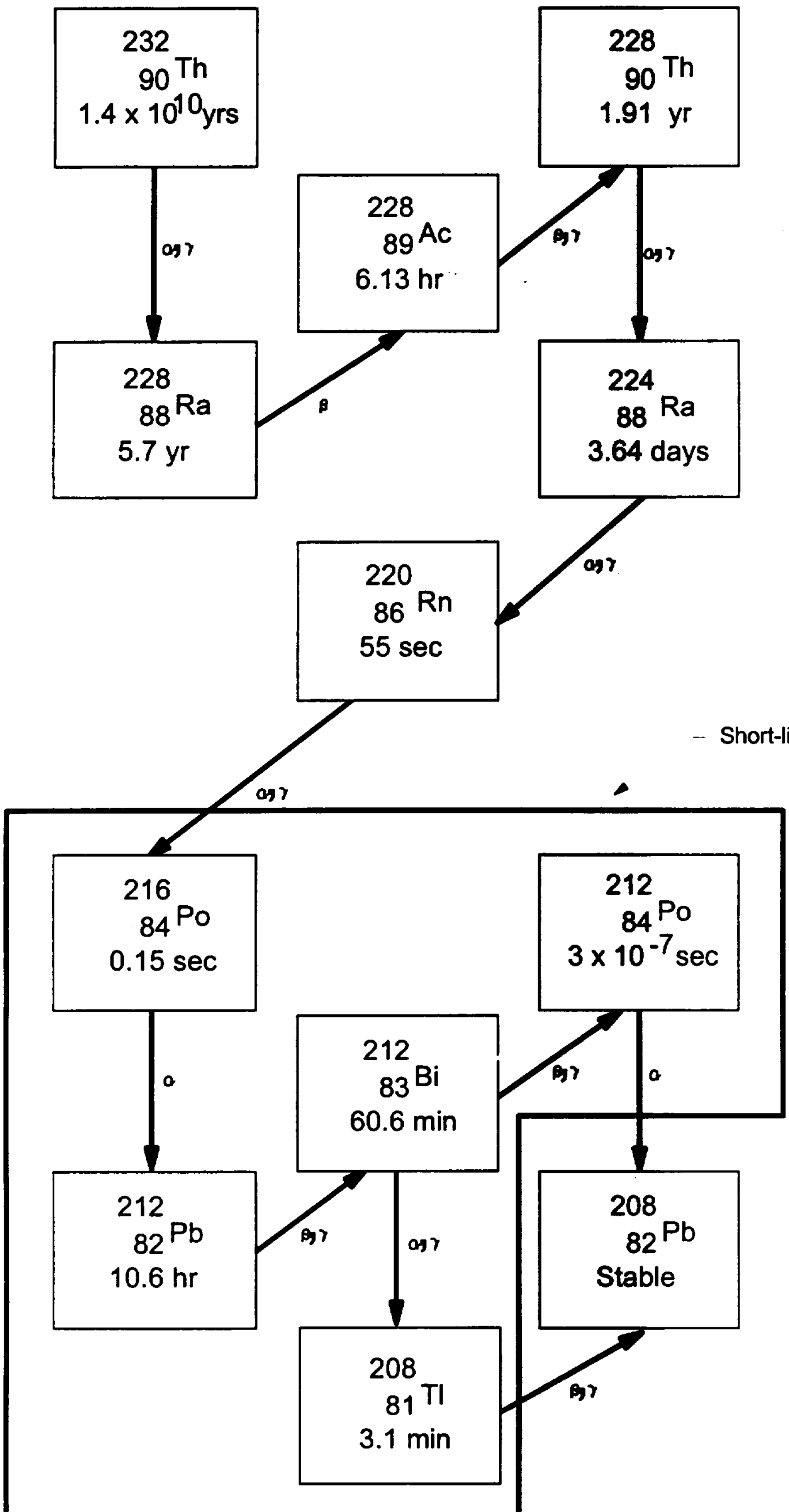
3.3.1 Radionuclides and Chemicals of Potential Concern

The baseline risk assessment will evaluate potential human exposure to radionuclides and other chemical contaminants present in soil, surface water, sediments, and possibly groundwater at the Site. The radionuclides that pose a potential risk to human health are the members of the thorium and uranium series, which are shown on Figures 3-4 and 3-5, respectively. These radionuclides were selected based upon preliminary review of the existing contamination pathways data using the following criteria:

- Measured concentration relative to background levels
- Carcinogenicity
- Site history

This selection was based on an evaluation of currently available analytical data and a review of the Site history. Further sampling and analysis to be performed is described in Section

FIGURE 3-4



ATOMIC WT.
ELEMENT
ATOMIC NO.
HALF - LIFE

Abbreviation	Element
Th	Thorium
Ra	Radium
Ac	Actinium
Rn	Radon
Po	Polonium
Pb	Lead
Bi	Bismuth
Tl	Thallium

– Short-lived thoron progeny

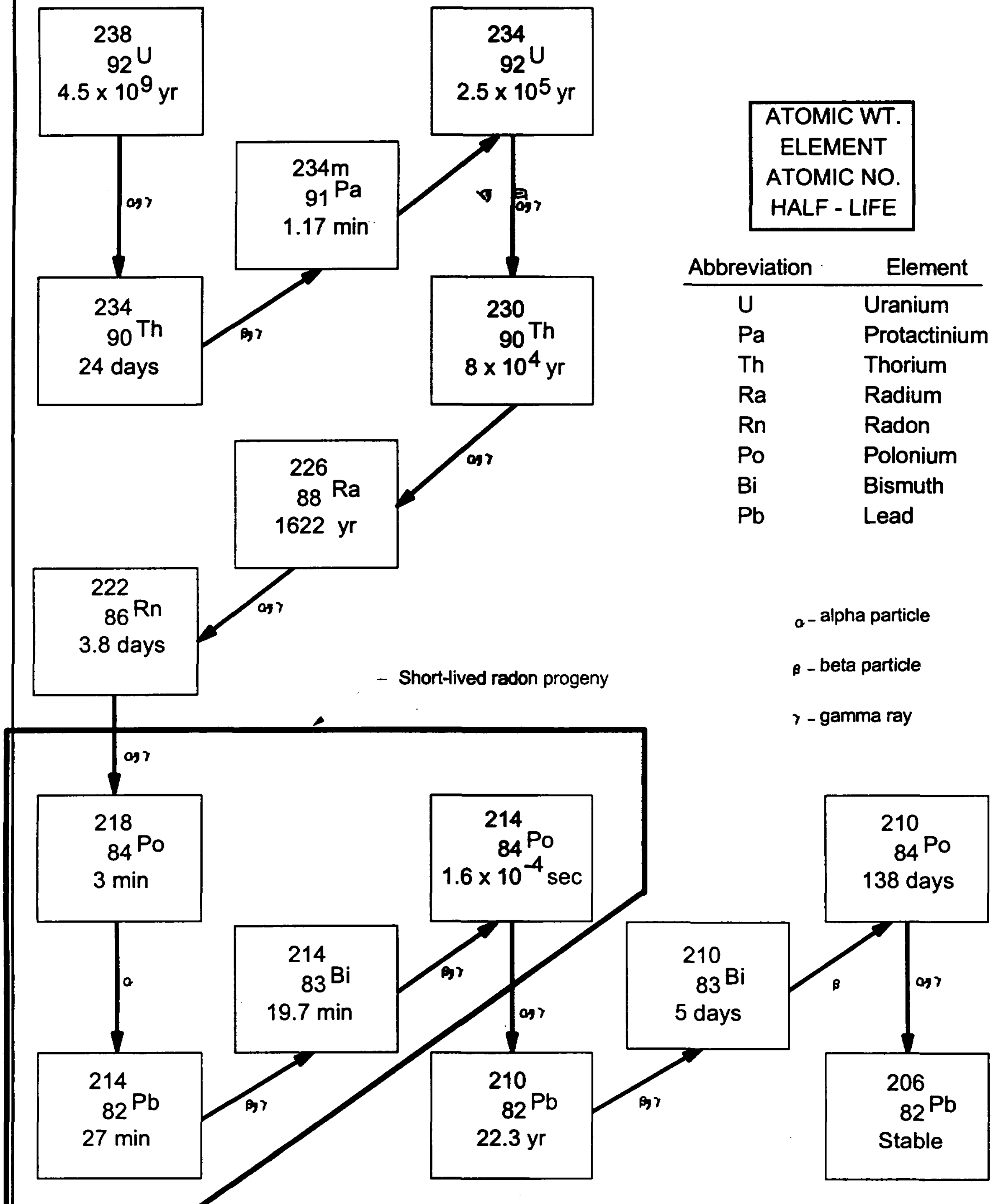
α - alpha particle

β - beta particle

γ - gamma ray

THORIUM SERIES DECAY CHAIN

FIGURE 3-5



Abbreviation	Element
U	Uranium
Pa	Protactinium
Th	Thorium
Ra	Radium
Rn	Radon
Po	Polonium
Bi	Bismuth
Pb	Lead

α - alpha particle

β - beta particle

γ - gamma ray

URANIUM SERIES DECAY CHAIN

5.3. Exposure to these radionuclides and other chemical contaminants via different exposure pathways will be evaluated in the FFS. Exposure pathways considered to be of potential significance are discussed below in Subsection 3.3.3.

3.3.2 Potential Source Areas and Release Mechanisms

The industrial operations conducted at the Li Tungsten facility resulted in one primary waste stream which needs to be addressed in this FFS. The primary stream consists of ore residues containing elevated concentrations of naturally occurring radioactive members of the thorium and uranium series. Some of this waste has been disposed of at the Site.

Infiltration and percolation through the soils to groundwater and surface waters are potential release mechanisms of Site contaminants. Surface runoff and discharge through stormwater drains are also potential release mechanisms from the Site.

3.3.3 Potential Exposure Pathways and Receptors

There is the potential for trespassers to encounter:

- residual radioactive and other chemical contamination in the surface soils;
- elevated exposure rates due to radiological contaminants scattered throughout the property.

Under future conditions, authorized and unauthorized individuals may continue to be exposed to Site conditions as described above. Additionally, there is the potential that Site contamination may spread. Further, it is possible that Site contaminants may migrate into groundwater supply wells. In this instance, additional receptors and exposure pathways may include residents and workers whose groundwater use consists of:

- private drinking water;
- public supply;
- commercial or industrial wells for process use.

3.3.4 Conceptual Site Model

A conceptual model for potential human exposure to the contaminants found at the Site is shown in Figure 3-6. As indicated, primary sources of contamination include disposal areas. Releases from these areas may occur by infiltration and percolation to groundwater and to soil and storm drains. Contaminants may be further released by the resuspension of radionuclide dust to the air, and by transfer via stormwater runoff to surface water, sediments and biota. Exposure of human and biota receptors to Site-related contamination may occur via external gamma irradiation, ingestion and inhalation. Human exposure may also occur via ingestion of locally grown produce grown in affected areas.

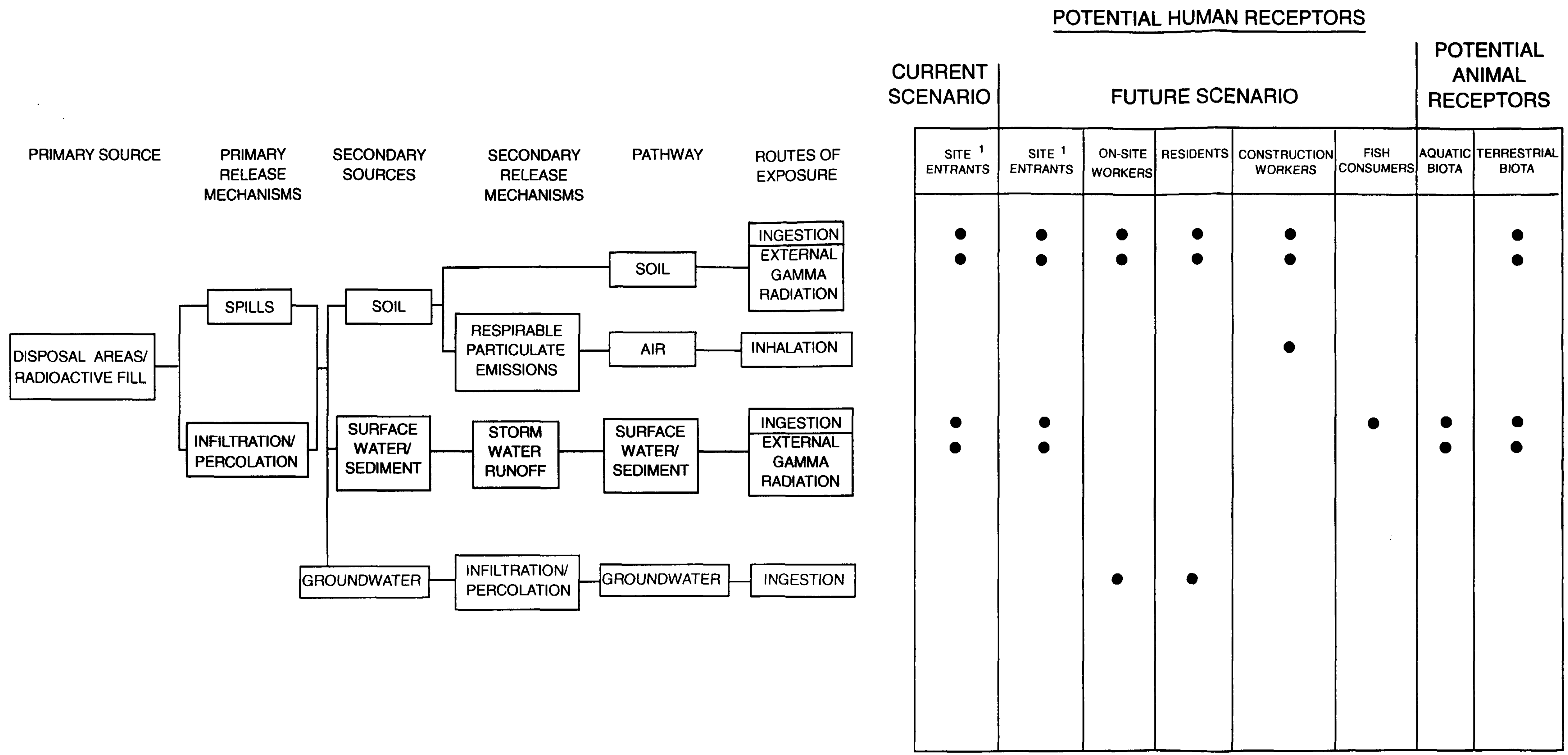
3.4 SUMMARY OF ADDITIONAL DATA NEEDS

During the preparation of this Draft Final Work Plan, a review of background documents (HART, 1989; Ebasco, 1995; NYSDEC, 1997; Roux, 1997) was conducted. None of the site-specific background data that currently exists defines the extent of radiologically contaminated tungsten ore residues at depth. To characterize the site during the field investigation portion of this FFS, strategic sampling and analysis of the potentially affected media is necessary. Our recommendations include the following:

- Perform radiological screening during all subsurface sampling activities conducted by Remedial Engineering/Roux Associates. If radiologically contaminated materials are encountered, collect samples for radiochemical and TAL/TCL laboratory analysis.

- Conduct air monitoring for radioactive particulates during the most intrusive activity (e.g., test pit excavation) performed by Malcolm Pirnie.

- Collect samples of wetland sediments for radiochemical analysis; collect samples of retention pond sediment, retention pond surface water and surface water locations for radiochemical and TAL/TCL analysis.



NOTES:

1 - AUTHORIZED AND UNAUTHORIZED (E.G. FIREFIGHTERS, TRESPASSERS).

CAPTAIN'S COVE

FOCUSED FEASIBILITY STUDY
CONCEPTUAL SITE MODEL

MALCOLM PIRNIE, INC.

FIGURE 3-6

- Perform gamma logging at six soil boring locations being sampled by Remedial Engineering/Roux Associates. In addition, perform gamma logging at soil boring locations (21 estimated) in the areas exhibiting elevated gamma radiation.

- Excavate test pits to delineate subsurface extent of ore residues and collect samples for radiochemical, TAL/TCL and waste characterization (e.g., TCLP Parameters, RCRA characteristics) analysis.

- Collect groundwater samples for radiochemical and TAL/TCL analysis

- Coordinate with Remedial Engineering/Roux Associates, who are performing the RI/FS on chemical contamination, to provide radiological screening of subsurface samples.

3.5 IDENTIFICATION OF PRELIMINARY REMEDIAL ACTION OBJECTIVES

Section 121(b) of CERCLA exhibits a preference for remedial actions in which treatment permanently and significantly reduces the volume, toxicity or mobility of the hazardous substances, pollutants, and contaminants. The remedial action must be protective of human health and the environment, cost effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

The purpose of this section of the Draft Final Work Plan is to identify potential remedial action objectives for each contaminated medium and a preliminary range of remedial action alternatives and associated technologies. It is a general classification of potential remedial actions based upon the initially identified potential routes of exposure and associated receptors identified in Section 3.3.

3.5.1 Preliminary Objectives

The FFS will address five media - soils, sediment, groundwater, surface water, and air. Preliminary remedial action objectives for these media include the following:

Soils

- Prevent exposure (i.e., ingestion, direct contact or inhalation) to soil with contaminant concentrations exceeding risk-based levels developed in the Baseline Risk Assessment.

- Prevent migration of contaminants that would result in groundwater, sediment, surface water or air concentrations exceeding the risk-based levels developed in the Baseline Risk Assessment.

- Remediate soils such that available ARARs and risk-based levels are attained at the end of the remedy.

Sediment

- Prevent exposure (i.e., ingestion, direct contact or inhalation) to sediment with contaminant concentrations exceeding risk-based levels developed in the Baseline Risk Assessment.

- Prevent migration of contaminants that would result in groundwater, surface water or air concentrations exceeding the risk-based levels developed in the Baseline Risk Assessment.

- Remediate sediments such that available ARARs and risk-based levels are attained at the end of the remedy.

Groundwater

- Prevent ingestion of groundwater having contaminant concentrations in excess of the risk-based levels developed in the Baseline Risk Assessment.

- Mitigate further migration of groundwater having contaminants in excess of the risk-based levels developed in the Baseline Risk Assessment.

- Remediate groundwater such that available ARARs and risk-based levels are attained at the end of the remedy.

Surface Water

- Mitigate further migration of surface water having contaminants in excess of the risk-based levels developed in the Baseline Risk Assessment.

Air

- Prevent inhalation of ambient air having contaminant concentrations in excess of the risk-based levels developed in the Baseline Risk Assessment.

3.5.2 Preliminary Response Actions, Remedial Technologies and Alternatives

To meet the above preliminary remedial action objectives, a set of general response actions were identified. These general response actions identify the areas to be investigated to meet objectives and fall into the following categories:

- No Action
- Limited Action

- Containment
- Removal
- Treatment

Listed below is a preliminary list of alternatives intended to provide a wide range of alternatives as a starting point for the FS, which involves the development, screening and detailed analysis of alternatives discussed in Section 5.10. Further investigations into alternatives will utilize USEPA guidance documents for treatment of soils/sludges (USEPA, 1988c) as well as other guidance documents. Some alternatives/treatment technologies (e.g., removal of volatile organics from both soils and groundwater) discussed below may only be applicable if a mixed waste exists. In this specific case, it may become necessary to treat the hazardous component of the mixed waste prior to implementing a final alternative.

3.5.2.1 Soil Treatment and Disposal

The contaminated soil at the Site can be remediated by excavation with on-site or off-site treatment/disposal, as discussed below. The remedial alternative selected would entail the treatment of contaminated soils to reduce or eliminate their potential risk to public health and the environment. The treatment alternatives will have to consider whether the soil is classified as radiological waste, or mixed waste with radiological and chemical contamination.

On-site or Off-site Treatment/Disposal

After excavation, on-site/off-site treatment technologies that might be used could include a separation technology such as soil washing to separate contaminants including the radiological portion, a destruction technology such as incineration, mechanical (thermal) aeration, or chemical or biological treatment to eliminate organic contaminants, or an immobilization/stabilization technology such as chemical fixation to reduce the mobility of organic or inorganic contaminants. The treated soil would be disposed of either by landfilling off site or by use as backfill on site.

Soil washing involves chemical and physical processes. The chemical process applies solvent or water extraction methodologies to remove contaminants (metals and organics) from the soil. Physical processes may include classification of the contaminated soil prior to extraction, removal of excess moisture from treated soil after extraction, and recovery of the spent extraction fluids. The waste water generated from soil washing would be treated in an on-site water treatment system.

Soil incineration is a process in which one of a number of thermal technologies is utilized to accomplish different phases of thermal reactions leading progressively to the complete oxidation of organic substances.

Thermal aeration involves the contact of clean air with the heated, contaminated soils to transfer the volatile organics from the soil into the air system. Depending upon the concentrations of contaminants, the air stream could be burned in an afterburner or passed through activated carbon for air pollution control.

Chemical fixation involves the addition of siliceous material combined with setting agents, such as lime or cement, resulting in a stabilized and solidified product. Commercial proprietary fixation agents and processes can be used for both inorganic and organic contaminated soils.

3.5.2.2 Groundwater Treatment and Disposal

The contaminated groundwater at the Site can be pumped and treated on-site or treated *in situ* as discussed below. USEPA guidance (USEPA 1988e) provides further information on groundwater remediation strategies and technologies. These technologies are generally applicable for the typical organic and inorganic contaminants. Some of them may be appropriate for radiological contamination, primarily the physical separation technologies such as filtration, adsorption, reverse osmosis or ion exchange.

On-Site Treatment/Disposal

On-site treatment technologies for removing volatile organics include air stripping, carbon adsorption, chemical oxidation, and biological treatment; treatment technologies for removing nonvolatile organics include carbon adsorption, chemical oxidation, and biological treatment; treatment technologies for removing inorganic contaminants include filtration, chemical precipitation, ion exchange, and reverse osmosis for removing nonvolatile organics. Several of these technologies may be necessary in a treatment train if the groundwater has radiological and chemical contamination. The technologies used to treat inorganic contaminants are likely to be effective on the radiological contaminants.

Air stripping is a mass transfer process in which volatile organic contaminants in groundwater are transferred to the gaseous vapor phase. Generally organic compounds with a Henry's Law constant of greater than 0.003 can be effectively removed by air stripping. Air stripping is an efficient process to treat aqueous groundwater with relatively high volatility, low water solubility organic contamination (e.g., chlorinated hydrocarbons such as tetrachloroethylene) and aromatics (e.g., toluene).

The process of adsorption onto activated carbon involves contacting a waste stream with the carbon, usually by flow through a series of packed or packed bed reactors. The activated carbon selectively adsorbs hazardous constituents in the waste by a surface attraction phenomenon, in which the organic molecules are attracted to the internal pore surfaces of the carbon granules. Activated carbon can be used for the adsorption of volatile and semivolatile organic contaminants of the groundwater.

If the results of the FFS indicate that the groundwater is contaminated with metals, chemical precipitation or ion exchange can be used to remove the metals. Chemical precipitation is a pH adjustment process in which acid or base is added to a solution to adjust the pH to a point where the constituents have their lowest solubility. Metals can be precipitated from solution as hydroxides, sulfides, carbonates or other insoluble salts. Hydroxide precipitation with lime is most common, however, sodium sulfide is sometimes used to achieve lower concentrations of metal in the treatment effluent. The resulting residuals are metal sludge and the treatment effluent, which has an elevated pH and (in the case of sulfide precipitation) excess sulfides. Ion exchange is a process whereby selective ions are removed from the aqueous phase by less harmful ions held by ion exchange resins.

Reverse osmosis can be used to remove dissolved solids, including sodium, to meet drinking water standards. In normal osmotic processes, solvent will flow across a semipermeable membrane from a dilute concentration to a more concentrated solution until equilibrium is reached. The application of high pressure to the concentrated side will cause this process to reverse. This results in solvent flow away from the concentrated solution, leaving an even higher concentration of solute.

3.6 NEED FOR TREATABILITY STUDY

Treatability studies are not planned at this time, however, they may be needed to complete evaluation of potential remedial technologies. Treatability studies are used to determine the performance capabilities of remedial technologies identified as appropriate for a specified contaminated medium. Generally, biologically-based treatment technologies require extensive laboratory analysis in order to be able to predict performance for a site specific application. Chemically-based treatment technologies typically require less rigorous investigation though a treatability study is recommended to develop process kinetics data. Physically-based technologies often require no treatability studies. Site and media characterization data will be important, but physically-based technologies can usually be directly tested at the field pilot scale.

4.0 WORK PLAN RATIONALE

4.1 DATA QUALITY OBJECTIVES

Data Quality Objectives (DQOs) for the FFS are qualitative and quantitative statements which specify the quality of data necessary to support determinations on:

- the nature, extent, and source(s) of radiological contamination in the soils, groundwater, surface water, sediment and air (e.g., distribution and transport of specific source(s) of contamination);
- the risks posed by the radiological contamination (e.g., human health) and
- remedial alternative evaluations (e.g., compliance with ARARs, reduction of toxicity and mobility).

DQOs ensure that the quality of data for specific FFS activities are acceptable for the intended use of the data and also ensure precision, accuracy, reproducibility, comparability and completeness.

The analytical DQO levels are defined as follows:

- Level I - field screening or analysis using portable instruments. Results are often not compound-specific and not quantitative, but results are available in real-time. It is the least costly of the analytical options.
- Level II - field analysis using more sophisticated portable analytical instruments; in some cases, the instruments may be set up in a mobile laboratory on-site. There is a wide range in the quality of data that can be generated. It depends on the use of the calibration standards, reference materials, sample preparation equipment, and the training of the operator. Results are available in real-time or several hours.

- Level III - analyses performed in an off-site analytical laboratory that may or may not use the USEPA Contract Laboratory Program (CLP) procedures, but do not usually utilize the validation or documentation procedures required of CLP Level IV analyses. The laboratory may or may not be a CLP laboratory.

- Level IV - CLP routine analytical services (RAS). Analyses are performed by an off-site CLP laboratory following CLP protocols. Level IV is characterized by rigorous Quality Assurance/Quality Control (QA/QC) protocols and documentation. Due to the potential for radioactive contamination in the samples collected at the Site, none of the samples may be analyzed by a CLP laboratory (analysis of radioactive samples is excluded from the CLP SOW).

- Level V - laboratory analysis for parameters using standard or non-standard methods performed outside of the CLP program (non-RAS). Analyses are performed by an analytical laboratory which may or may not also be a CLP laboratory. Method development or modification may be required for specific constituents or detection limits. Non-RAS laboratories are procured by the ARCS Contractor. All non-RAS laboratory analytical data are Level V.

The purpose of this Section is to provide the DQOs deemed necessary for this FFS based upon evaluation of existing site information, the preliminarily defined ARARs, human health and ecological risks, and remedial alternative objectives, as identified in Section 3.0 of this Draft Final Work Plan. Refinements to the DQOs may become necessary as this FFS project progresses and will be in accordance with the most recent guidance document for DQOs (USEPA, 1994a).

To achieve the stated objectives of the FFS, field investigations will be undertaken which will primarily generate Levels I and V analytical data. Levels II, III and IV analyses are not planned during the FFS (except for any treatability studies that may be performed at a later date). Where data have multiple uses, the uses are prioritized and assigned the highest analytical level for a particular use. The analytical uses are discussed below.

The Level I data to be generated include field OVA or HNu readings gathered as part of the health and safety monitoring (air monitoring) conducted as part of the field activities. These are real-time data used for the immediate evaluation of field conditions. The gamma logging survey data and field measurements of parameters such as radiation exposure rates, pH, temperature and specific conductance, and turbidity of water samples are also examples of Level I data which will be collected at the Site.

The Level V data to be generated will include non-RAS analysis for radionuclides, TAL/TCL compounds and RCRA Characteristics (Corrosivity, Ignitability, Reactivity and TCLP Parameters), Total Organic Carbon (TOC) and Total Dissolved Solids (TDS). In addition, physical properties of soil/sediments such as cation exchange capacity, hydraulic conductivity, grain size analysis, bulk density, atterberg limits and moisture content will be Level V data and require the use of a non-RAS laboratory.

4.2 WORK PLAN APPROACH

The objectives of the FFS were developed based on existing radiological data on the surficial soils. There is no existing radiochemical data on the groundwater at the Site. The available information that was compiled included published reports, regional and local geology and hydrogeology and field observations during a site visit. The main objective of the FFS is to characterize the nature and extent of the radiological contamination, identify distribution and migration pathways, and evaluate remedial alternatives.

A total of five media (soil, sediment, groundwater, surface water and air) will be sampled, however, the investigation will be primarily focussed on the soils (the largest potential source of residual contamination). Surface water is only found in the two retention ponds; radionuclides of interest are generally relatively insoluble in groundwater, and air monitoring during ore relocation activities at the Li Tungsten Site did not indicate that airborne transport of radioactive particulates was significant.

The scope of the field investigation has been prepared in accordance with USEPA guidance manuals on conducting RI/FS. This Draft Final Work Plan proposes the installation of two new groundwater monitoring well because it is felt that the network of existing wells (which were determined by Roux Associates to be in good condition) and those proposed by Remedial Engineering/Roux Associates provide sufficient site-wide coverage. The recommended overall approach to conducting the FFS includes:

- Evaluation of existing data;
- Determination of additional data needs and data quality objectives;
- Data collection activities;
- Sample analysis and validation;
- Data evaluation;
- Determination on necessity for treatability studies;
- Baseline risk assessment;
- Evaluation of remedial technologies and alternatives
- Report.

Uncertainties at the Site include the extent of subsurface soil, sediment, surface water, groundwater and air contamination and the concentration of the radionuclides of concern that are present. To achieve the objectives of the FFS and to meet the data needs of the RD as presented in Section 3.4, the field activities proposed include the following:

<u>Soil Borings</u>

A total of 21 soil borings will be drilled as part of the FFS; 15 of the borings will assess the nature and extent of radiological contamination in the areas known to have elevated gamma levels in the surface soils; six of the borings are adjacent to shallow monitoring wells being installed as part of the State of New York's RI/FS. Samples collected from the soil borings will be analyzed for radionuclides (100%) and TAL/TCL compounds (approximately 50%). Selected samples will be analyzed for physical/chemical properties to evaluate treatment technologies and waste classification. Soil samples from another six soil borings drilled by Remedial Engineering/Roux Associates on a site-wide basis may be submitted for laboratory analysis depending upon results of the radiation field screening.

Test Pits

Six test pits will be excavated in areas where surface anomalies have identified gamma radiation. Test pitting activities by Remedial Engineering/Roux Associates will also be monitored for radiation. Samples collected from the test pits will be analyzed for radionuclides (100%) and TAL/TCL compounds (approximately 50%). Selected samples will be analyzed for physical/chemical properties to evaluate treatment technologies and waste classification.

Gamma Logging

Gamma logging will be performed in a total of 27 soil borings; 21 drilled as part of the FFS investigation and six additional soil borings drilled during the State's RI/FS.

Surface Water, Sediment and Wetlands Sampling

Sediment samples from the wetlands, sediment and surface water (where present) samples from the two retention ponds and one topographic depression will be collected and analyzed for radionuclides. The sediment samples collected from the wetlands will not be analyzed for TAL/TCL compounds because this area was previously sampled and analyzed by Roux Associates; all other sediment and surface water samples will be analyzed for TAL/TCL compounds.

Groundwater Investigation

Two new groundwater monitoring wells are proposed: one in Area G and one near Area A where elevated gamma levels were measured in the surface soils. Groundwater samples will be collected from the four existing monitoring wells, the six new monitoring wells installed by Remedial Engineering/Roux Associates, and the two new wells installed by Malcolm Pirnie. Groundwater samples will be analyzed for radionuclides, TAL/TCL compounds and selected chemical parameters. Results of the laboratory analysis will be used to estimate the horizontal and vertical distribution of radiological contaminants, assess contaminant mobility, and evaluate potential treatment options. Groundwater and regional surface water levels (staff gages) will be measured twice to determine groundwater flow direction.

Surface Gamma Survey

A surface gamma survey will be conducted to obtain surface exposure readings in areas that could not be surveyed during the NYSDEC investigation (NYSDEC, 1997).

Air Monitoring

Real time air sampling for airborne particulates will be conducted during the test pit excavations in areas exhibiting elevated exposure rates to assess the presence of other airborne radiological contaminants. Portable hand-held wind vane/anemometer will be used on-site during the intrusive phases of the field investigation to estimate the wind direction and speed.

4.3 SUMMARY

Section 5.0 of this Draft Final Work Plan provides the general scope of work for each of the planned field activities. Amendments to the Li Tungsten FSP and the QAPjP will outline the detailed sampling and analytical procedures for each medium to be sampled, the number and type of each sample, the QA/QC sample requirements for each medium and the site-specific health and safety requirements and measures. The DQO for each sample type will be identified in the amended FSP based on the highest analytical level for the intended use of the data. The amended FSP will also identify precision, accuracy and completeness goals used in selecting the sampling and analysis methods. The amended FSP will also contain details of non-laboratory data collection, such as SOPs for well installation, and the collection of soil and water samples. These documents will be revised after this Draft Final Work Plan is approved by the USEPA.

It is believed that the scope of work defined herein is sufficient to support the objectives of the FFS. Should the results of the field investigations show that the extent and nature of contamination are not sufficiently defined to support the risk assessment and FS, it may be necessary to recommend additional investigations be implemented. Table 4-1 presents a summary of the proposed sampling program including the media to be sampled, the types of data to be collected, the analytical level to be achieved and the analytical parameters.

TABLE 4-1
SUMMARY OF PROPOSED FFS SAMPLING PROGRAM

MEDIA	TYPE OF INVESTIGATION	LOCATION OF INVESTIGATION	DATA USES	DATA QUALITY LEVEL	PROPOSED ANALYSES
Soils	Subsurface Soil Sampling	· Soil Borings · Test Pits · Monitoring Well Borings	Site Characterization Risk Assessment Alternative Evaluation	V	Physical Properties, RCRA Charact., ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{234}U, ^{238}U, TAL/TCL
	Borehole Gamma Logging	· Soil Borings	Same as above	Not Applicable	Gamma Radiation
	Surface Exposure Survey	· Condominium Shells Areas · Gate Areas · Bank of Tidal Wetland · Area bordering Area G	Site Characterization	I	Gamma Radiation
Ground Water	Monitoring Well Sampling	· New monitoring wells · Existing monitoring wells	Same as above	V	TAL/TCL, ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{234}U, ^{238}U
Surface Water	Surface Water Sampling	· Retention Ponds · Topographic Depression	Same as above	V	TAL/TCL, ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{234}U, ^{238}U
Sediment	Sediment Sampling	· Retention Ponds · Wetlands · Topographic Depression	Same as above	V	Physical Properties, RCRA Charact. ^{228}Th, ^{230}Th, ^{232}Th, ^{226}Ra, ^{228}Ra, ^{234}U, ^{238}U, TAL/TCL
Air	Air Sampling	· During Test Pit Operations	Worker Protection	I	Alpha Particles

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5.0 TASK PLANS FOR THE FFS

5.1 TASK 01 - PROJECT PLANNING

The project planning task involves several subtasks that must be conducted to develop the plans and corresponding schedule necessary to execute the FFS. These subtasks include conducting a detailed analysis of existing data, review existing project plans, conduct site visit(s), develop a preliminary risk assessment, identify preliminary remedial alternatives, determine preliminary DQOs, and determine preliminary ARARs. All of these activities culminate in the preparation of the final project plans. The detailed analysis of existing data, identification of preliminary ARARs, the development of the preliminary risk assessment, remedial action objectives/alternatives, as well as identification of DQOs, are contained in Sections 3.0 and 4.0 of this Draft Final Work Plan.

The project plans include the preparation of this Draft Final Work Plan and modifications to the Li Tungsten RI/FS Field Sampling Plan (FSP) and the Quality Assurance Project Plan (QAPjP). Modifications to the Li Tungsten FSP and QAPjP will be prepared after the Draft Final Work Plan is approved by the USEPA. A Site-Specific Safety and Health Plan (SSHP) has been prepared. The SSHP includes elements described in Appendix B of the RI/FS guidance document (USEPA, 1988a), and complies with OSHA and 29 CFR 1910.120.

The QAPjP describes the policy, organization, functional activities, and quality assurance and quality control protocols necessary to achieve DQOs dictated by the intended use of the data. The FSP provides guidance for all fieldwork by defining, in detail, the sampling and data-gathering methods to be used on the project. Field methods, sampling procedures, and custody shall be based on established protocols (USEPA, 1987c). The QAPjP and FSP will contain the elements listed in Table 2-4 and described in Appendix B of the RI/FS guidance document (USEPA, 1988a).

The FSP consists of five main chapters on the following topics:

- Site background
- Sampling Objectives
- Sample locations, frequency and designation
- Sampling procedures and equipment
- Sample handling

Each SOP or QA/QC protocol in the FSP will be prepared in accordance with USEPA Region II guidelines and the SSHP. The QA/QC portions of the FSP will be prepared in accordance with USEPA Region II Standard Operating Procedures (SOPs), Section 10 of SW-846 (USEPA, 1986c) and the Region II QA/QC Manual (USEPA, 1992b: 1989d).

TAL/TCL laboratory data generated by non-RAS laboratories will be validated by USEPA Region II trained and certified personnel using USEPA's CLP SOW and functional guidelines for data review (USEPA, 1996b; 1994b; 1992c; 1991a). Radiological data will be validated by Region II trained and certified personnel using the validation protocols presented in Appendix A.

5.2 TASK 02 - COMMUNITY RELATIONS

Community relations support will consist of: (1) assisting the USEPA in the preparation and distribution of fact sheets and the Proposed Plan; and (2) present the findings of the FFS, describe the USEPA's proposed remedy, and to elicit and respond to comments received at a public meeting.

5.3 TASK 03 - FIELD INVESTIGATION

5.3.1 Overall Objective

The purpose of the field investigation is to obtain valid data to evaluate the potential sources of contamination by defining the nature, depth and extent of contamination resulting from operations at the Site.

The data generated during the field investigation will be used to assess what risks, if any, the radiological contamination resulting from operations at the Site presents to public health and to the environment. Based on these data, it will be determined whether the radiological contaminants are of sufficient concentration to warrant a remedial action. Finally, the data will be used to evaluate appropriate remedial response alternatives for the Site.

5.3.2 Coordination with City/State Consultant

Coordination activities will be necessary with the consultant (Remedial Engineering/Roux Associates) performing the RI/FS for the City/State. Coordination efforts will be necessary in the pre-mobilization phase, during the field investigation, data evaluation and report writing stages, and possibly during preparation of the Baseline Risk Assessment.

For the purposes of this Draft Final Work Plan, the FFS field investigation activities that will be conducted at the Site will take place in two phases. The RI/FS field investigation activities being conducted by Remedial Engineering/Roux Associates to investigate the non-radiological areas of the Site is likely to be initiated before the FFS field investigation. The Phase I FFS activities consists of providing radiological field screening of all samples collected by Remedial Engineering/Roux Associates, collection and analysis of any samples that may be determined to contain higher than background levels of radioactivity, gamma logging of soil borings. Phase II FFS field activities include sampling activities (e.g., wetlands, retention pond, surface water and groundwater sampling) that are either related to but independent of field activities being conducted by Remedial Engineering/Roux Associates, or as part of the radiological field investigation.

5.3.3 Subcontracting

To support the proposed field activities, the following subcontracts will be required:

- A drilling subcontract for soil borings and excavation of test pits.
- A laboratory subcontract for non-RAS laboratory analytical services for radiological and chemical parameters.

- A waste hauling subcontract to remove drill cuttings/residuals and purged groundwater from the Site.

- A surveying subcontract for surveying of monitoring well and staff gauge locations and elevations and surface water, sediment, and soil sample locations.

Selection of subcontracts will be achieved utilizing Part 14 of the Federal Acquisition Regulations (FAR), "Sealed Bidding", when adequate competition is deemed to be available for services such as drilling, waste hauling and laboratory analytical services Other subcontracts will be awarded in accordance with Part 15 of the FAR entitled "Contracting by Negotiations". Consistent with MPI's ARCS II procurement policy and procedures, all subcontracts in excess of $10,000 will be solicited by a competitive bid process and those in excess of $25,000 will be submitted to the USEPA CO for consent.

It is MPI's policy to obtain full and open competition on all procurements in excess of $25,000. A diligent effort will be made to procure the services of qualified Small Business Enterprises (SBEs) or Small Disadvantaged Business Enterprises (SDBEs).

5.3.4 Mobilization and Demobilization

This subtask will include field personnel orientation, equipment mobilization, the staking of sampling locations, and demobilization. Each field team member will attend an on-site orientation meeting to become familiar with the history of the Site, health and safety requirements, and field procedures.

Equipment mobilization will involve the ordering, purchasing, and if necessary, fabrication of equipment needed for the field investigation. A complete inventory of equipment required for the field investigation will be prepared prior to initiating field activities. The field office trailer at the Li Tungsten site will be used as the base of operations. At the present time, the time lapse between the end of Phase I and the beginning of Phase II is assumed to be approximately one month, so there will be a partial demobilization at the end of Phase I and a second remobilization prior to the beginning of Phase II.

Locations of the surface soil samples, soil borings and test pits will be field checked and staked at the start of the site operations. The locations will be measured from existing landmarks. A utilities check and stakeout will be conducted at the location of each subsurface investigation.

Equipment mobilization may include (but will not be limited to) sampling equipment, drilling subcontractor equipment, and health and safety decontamination equipment. Equipment will be decontaminated and demobilized at the completion of each phase of field activities as necessary.

Decontamination solutions, drill cuttings and purge water will be stored on-site in DOT-approved 55-gallon drums or in an on-site tank. The drums will be permanently numbered and an inventory of their contents maintained. The disposal of drummed drill cuttings, decontamination water, purge water, and health and safety equipment at the time of demobilization, will be the responsibility of MPI. Off-site disposal of wastes generated during the FFS field activities that are determined to be hazardous, will be carried out by MPI under the contractual provisions of indemnification within three months of receipt of all validated laboratory data. Wastes that exhibit elevated levels of radioactivity will be moved to the Dickson Warehouse on the Li Tungsten site for temporary storage with other ore residue materials.

5.3.5 Radiological Characterization

5.3.5.1 Surface Exposure Rate Survey

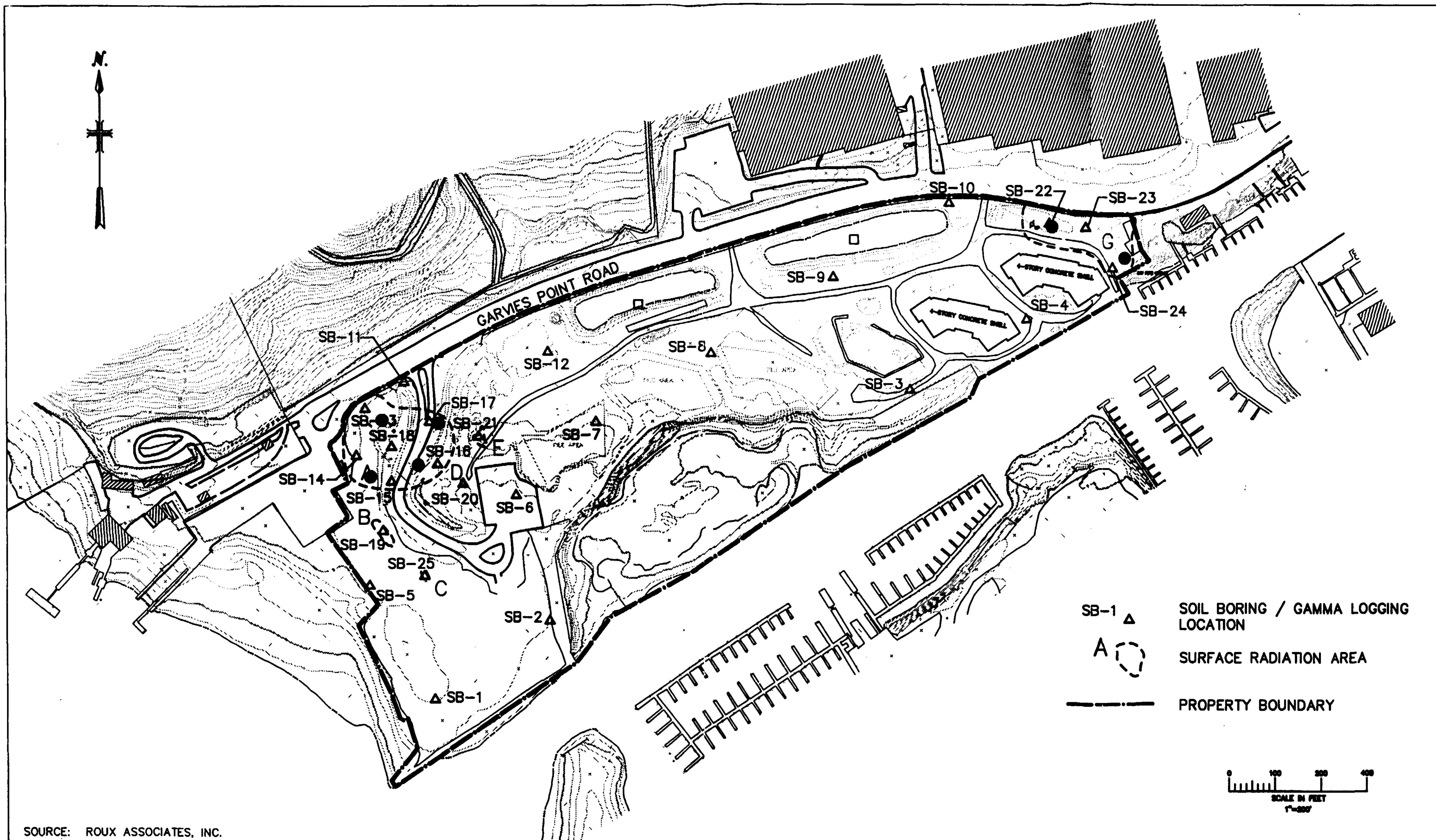
There were some areas of the Site that were inaccessible to the NYSDEC during their surficial radiological survey. These areas include in front of both condominium shells, under the west condo shell, inside and outside of the gate, and along the wetland bank. Comprehensive surface exposure rate surveys will be collected with 1" x 1" NaI gamma scintillation detectors coupled to suitable ratemeters in areas which were not surveyed by NYSDEC. If practical, grid lines will be placed along ten foot intervals and measurements will be taken at each intersection of grid lines at the surface and at approximately waist (3 foot) height. The areas within each grid square will be surface scanned; areas exhibiting elevated exposure rates will be documented. A scanning survey is necessary to locate isolated areas with surface and near-surface radiological contamination.

For quality control purposes, readings will also be taken with a Pressurized Ion Chamber (PIC). PIC data will be used to perform an "in-field" correction of the NaI detector response utilized in the gamma surveys. This is necessary because the response of a NaI detectors is dependent on the energies of the photons being measured. However, they are calibrated to a monoenergetic gamma emitter. Therefore, in the field, the NaI will either over-respond or under-respond to the incident photons, depending on the mix of energies present. The response of the PIC is extremely flat, i.e., it is not affected to nearly the same degree by gamma ray energies. Comparing the "true" exposure rate (as determined with a PIC) to the measured exposure rate with the NaI detector enables the calculation of a "correction factor" which can be applied to NaI detector response data.

5.3.5.2 Soil Borings

A soil boring program consisting of 21 soil borings is proposed, however, information will be collected from a total of 27 soil borings. Of the 21 soil borings being drilled as part of the FFS investigation, 15 are proposed in surficial areas exhibiting elevated gamma exposure rates. Six soil borings are proposed on a site-wide basis in areas that did not exhibit elevated gamma exposure rates where monitoring wells are being installed by Remedial Engineering/Roux Associates. Another six site-wide soil borings will be drilled during the RI/FS investigation. The objective of the soil boring program is to characterize vertical extent of subsurface radiological contaminants. Soil boring locations (SB-1 through SB-27) are shown in Figure 5-1.

Results of the NYSDEC surface radiological survey (NYSDEC, 1996) were primarily used as the basis for selecting the 15 proposed locations in areas exhibiting elevated gamma exposure rates. Six borings are located in the area identified by the NYSDEC as Area A (western end of the Site), four borings are located in the area identified by the NYSDEC as Area G (eastern end of Site), one boring is located in two small areas on the western end of the Site identified by NYSDEC (Areas B and E) exhibiting surface radiological



MALCOLM PIRNIE

TITLE:

SOIL BORING & GAMMA LOGGING LOCATIONS

CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

DATE: NOV. 1997

PROJECT NO.: 8001202

FIGURE NO.: FIGURE 5-1

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contamination, and three boring locations will be determined in the field (one location will be in Area C identified by NYSDEC). The final six locations will be located site-wide adjacent to monitoring wells installed by Remedial Engineering/Roux Associates. All of the soil borings will be drilled and sampled during Phase II.

Soil borings will be drilled to a depth of 15 feet using a truck-mounted drilling rig with hollow stem augers. Split-spoon soil samples utilizing standard penetration tests (SPT) consistent with ASTM D-1586 will be collected continuously in each boring. Each sample will be screened with a Geiger Mueller (GM) pancake detector to scan for radioactive material. Split-spoon samples will be visually described and classified according to the modified Burmeister System. Samples from each borehole which show the greatest response on the GM pancake detector will be sent to the laboratory for radiological analysis. A minimum of two samples per soil boring will be collected for analysis if the GM pancake detector scanning indicate that any material extracted from the borehole exhibits a count rate which differs from that due to background. If the GM pancake detector indicates only background count rates, one soil sample will be collected and sent to the non-RAS laboratory for confirmatory analysis.

As part of the RI/FS being conducted by Remedial Engineering/Roux Associates (Phase I), another six soil borings will be drilled and sampled on a site-wide basis. MPI personnel will screen each sample with a Geiger Mueller (GM) pancake detector to check for radionuclides. Split-spoon samples will be visually described and classified according to the modified Burmeister System. Samples selected for laboratory analysis will be made in a manner consistent with the approach described above for the soil borings being drilled for the FFS investigation.

Soil boring samples will be analyzed by a non-RAS laboratory for radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U - 100% of all samples) and TAL/TCL compounds (approximately 50% of all samples). If any of the samples collected in the borings drilled by Remedial Engineering/Roux Associates are selected for radiological analysis, they will also be analyzed for TAL/TCL parameters.

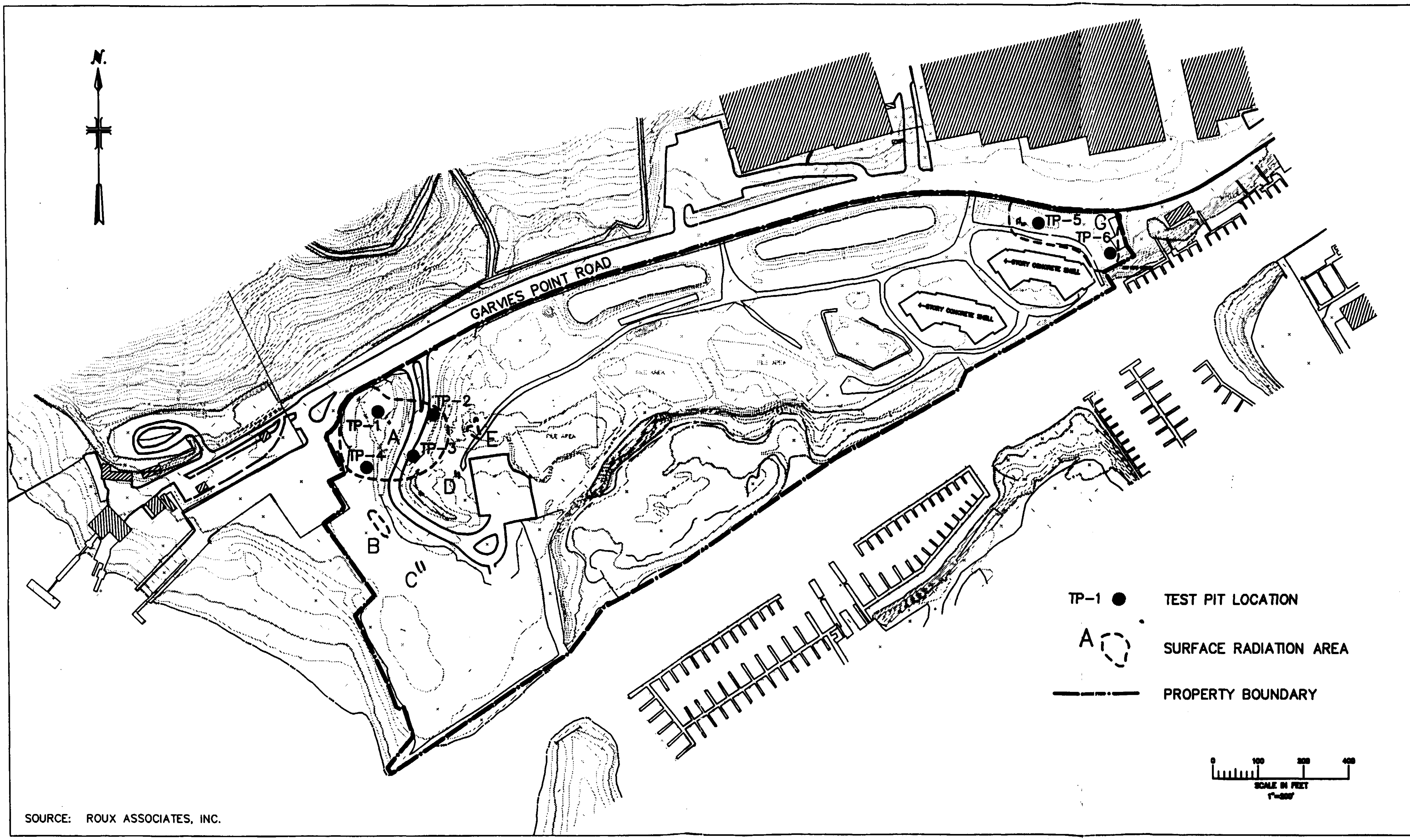
5.3.5.3 Test Pits

Six test pits will be excavated in areas of known surficial radiological contamination: four in Area A and two in Area G to determine the vertical extent of radiological contamination and to collect up to three soil samples per test pit. Another three test pits may be excavated in unspecified areas if radiological contamination is discovered at depth in any of the site-wide soil borings. The tentative location of the six test pits in Areas A and G (TP-1 through TP-6) are shown on Figure 5-2; the final locations will be determined in the field based on the results of the soil boring program. In addition, soils or wastes removed from test pits excavated by Remedial Engineering/Roux Associates (estimated to be approximately 16 test pits) will be monitored with a GM pancake detector for radionuclides. Test pit soil samples will be visually described and classified according to the modified Burmeister System. Samples which show the greatest response on the GM pancake detector will be sent to the laboratory for radiological analysis. A minimum of two samples per test pit will be collected for analysis. Test pit samples will be analyzed by a non-RAS laboratory for radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U - 100% of all samples) and TAL/TCL compounds (approximately 50% of all samples). If any of the test pit samples collected by Remedial Engineering/Roux Associates are selected for radiological analysis, they will also be analyzed for TAL/TCL parameters.

5.3.5.4 Surface Water, Sediment and Wetlands Sampling

A sediment and surface water (where present) sample will be collected from a topographic depression in the southwestern portion of the Site and each of the two retention ponds. Five sediment samples will be collected from the wetlands located in the south-central portion of the Site. If groundwater seeps are observed upgradient of the wetlands, two additional sediment and water samples will be collected from these areas.

Sediment samples will be visually described and classified according to the modified Burmeister System. Samples which show the greatest response on the GM pancake detector will be sent to the laboratory for radiological analysis. The sediment and surface water samples will be analyzed by a non-RAS laboratory for radionculides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U - 100% of all samples) and TAL/TCL compounds (approximately



MALCOLM PIRNIE		TITLE: TEST PIT LOCATION MAP	CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY GLEN COVE, NEW YORK USEPA REGION II ARCS CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L	DATE: NOV. 1997	PROJECT NO.: 8001202 FIGURE NO.: FIGURE 5-2

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50% of all samples). The wetland samples will be analyzed by a non-RAS laboratory for radionculides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U only (Roux Associates collected wetland samples for TAL/TCL analysis). The proposed sediment (SED-1 through SED-3), surface water (SW-1 through SW-3) and wetland sediment (WS-1 through WS-5) sampling locations are shown in Figure 5-3. The actual sample locations will correspond to the Remedial Engineering/Roux Associates sample locations. This activity is considered to be independent of the RI/FS activities, therefore, the samples may be collected during Phase I, but most likely will be collected during Phase II.

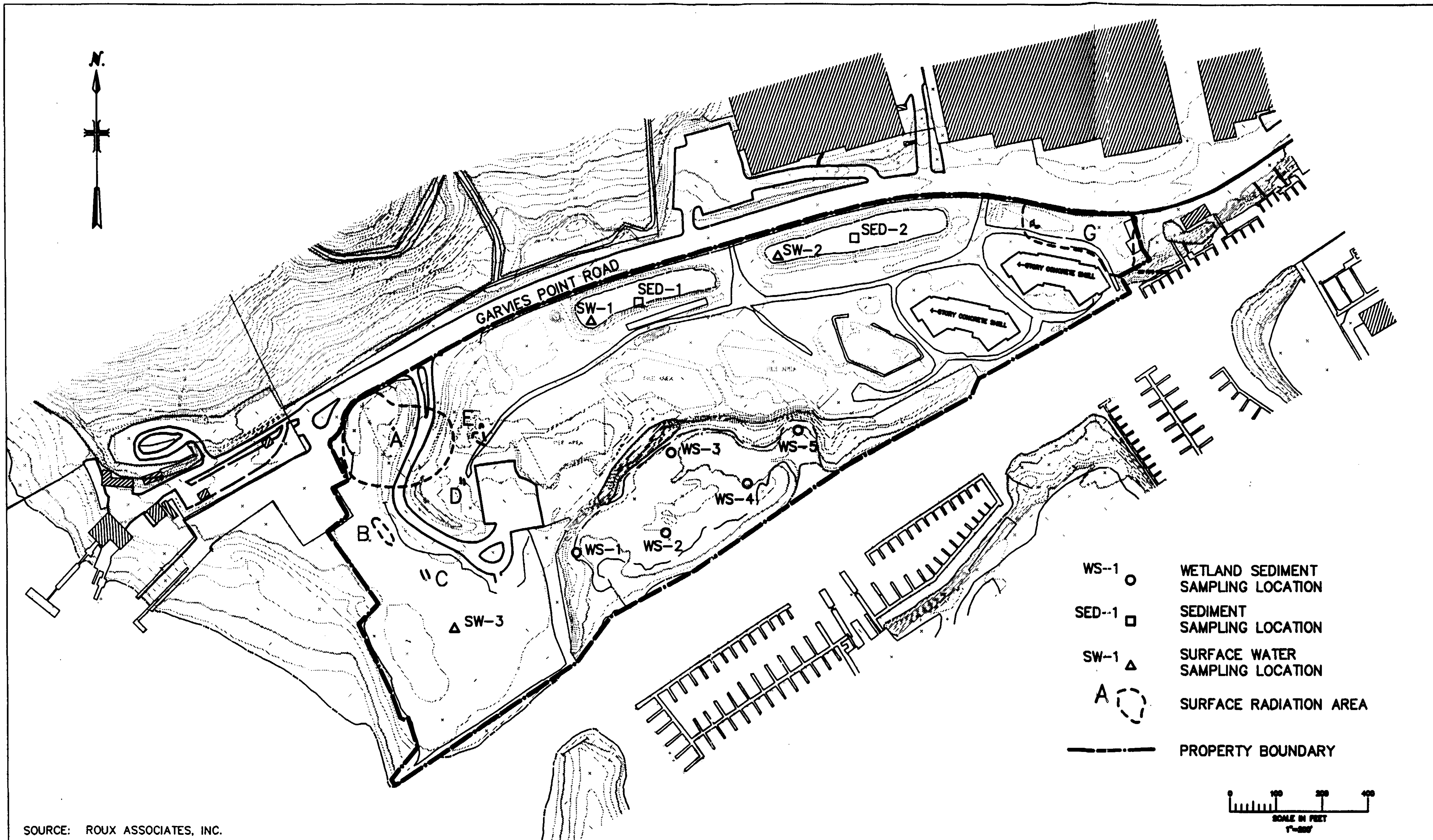
5.3.5.5 Downhole Gamma Logging

Following completion of the soil borings, a hollow piece of 3-inch diameter PVC pipe, capped at one end, will be inserted into each of the 21 boreholes to depth of approximately 15 feet below ground surface. Downhole gamma logging will be performed by taking 30-second count readings at 6-inch depth increments, beginning at the ground surface. Downhole gamma logging measurements will be taken with a NaI scintillation detector (2" x 2" crystal) coupled to a portable ratemeter/scaler. The profile of gamma radiation intensity will be used to estimate the depth of contamination within the immediate vicinity of the borehole. When evaluated in conjunction with surface exposure rate measurements and soil sample data, it will be possible to estimate the volume of contaminated materials.

The six soil borings being completed as part the RI/FS being conducted by Remedial Engineering/Roux Associates, will also be gamma logged using the procedures described above. The total number of soil borings that will be gamma logged is 27 (six during Phase I and 21 during Phase II).

5.3.5.6 Monitoring Well Installation

Two additional monitoring wells (MW-7 and MW-8) will be installed for collecting groundwater samples for chemical and radiological analysis, and for measuring groundwater elevations to estimate the direction of groundwater movement. The location of the new monitoring wells are shown on Figure 5-4. The shallow monitoring wells will be installed



SOURCE: ROUX ASSOCIATES, INC.

MALCOLM PIRNIE		TITLE: SURFACE WATER, SEDIMENT AND WETLANDS SAMPLE LOCATION MAP	CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY GLEN COVE, NEW YORK USEPA REGION II ARCS CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L DATE: NOV. 1997	PROJECT NO.: 8001202 FIGURE NO.: FIGURE 5-3

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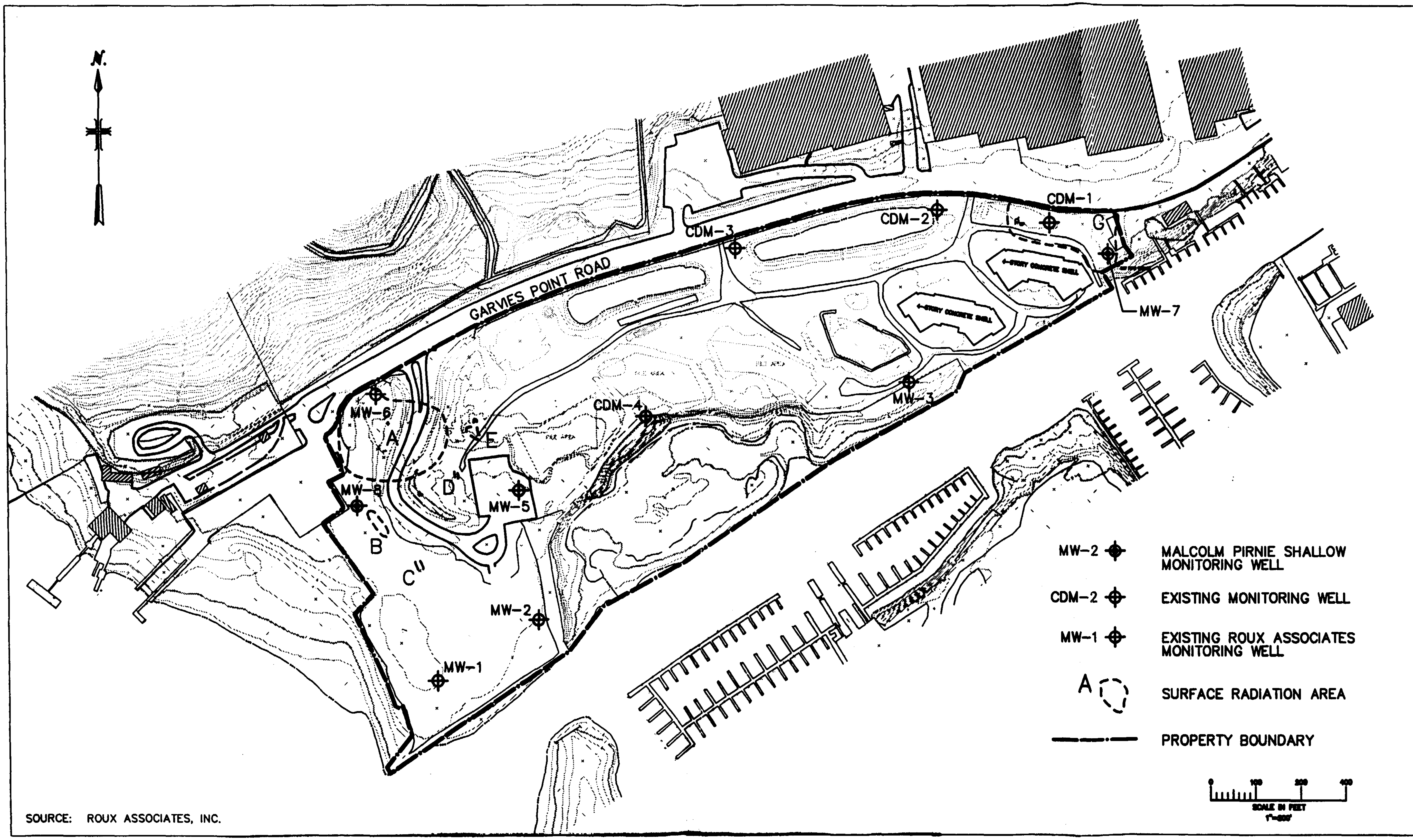

MALCOLM PIRNIE

TITLE: MONITORING WELL LOCATION MAP

CAPTAIN'S COVE ADJUNCT FOCUSSED FEASIBILITY STUDY
GLEN COVE, NEW YORK
USEPA REGION II ARCS
CONTRACT NO. 68-W9-0051; W.A. NO. 025-2L4L

DATE: NOV. 1997

PROJECT NO.: 8001202

FIGURE NO.: FIGURE 5-4

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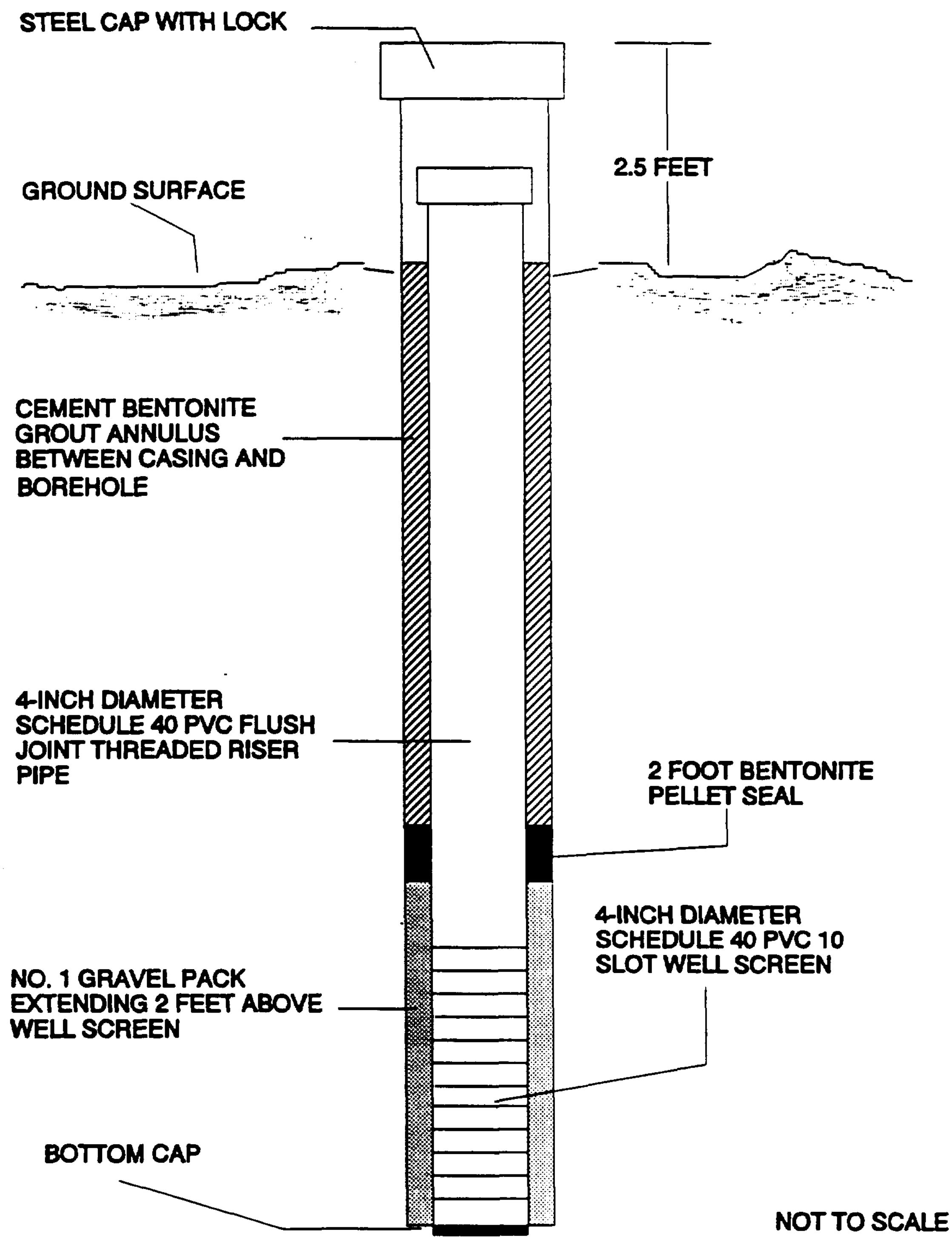
to bridge the water table with four feet of the well screen set above the water table and six feet below to allow for seasonal and tidal fluctuations in water level.

The well borings will be drilled with a hollow stem auger rig. Split-spoon soil samples utilizing standard penetration tests (SPT) consistent with ASTM D-1586 will be collected continuously in each boring. Each sample will be screened with a Geiger Mueller (GM) pancake detector to scan for radioactive material. Split-spoon samples will be visually described and classified according to the modified Burmeister System. Samples from each borehole which show the greatest response on the GM pancake detector will be sent to the laboratory for radiological analysis. A minimum of two samples per soil boring will be collected for analysis if the GM pancake detector scanning indicate that any material extracted from the borehole exhibits a count rate which differs from that due to background. If the GM pancake detector indicates only background count rates, one soil sample will be collected and sent to the non-RAS laboratory for confirmatory analysis. Monitoring well boring samples will be analyzed by a non-RAS laboratory for radionuclides (^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U) and TAL/TCL compounds.

Monitoring well design and installation will conform with USEPA and NYSDEC requirements. The monitoring wells will be constructed with four-inch diameter PVC casing and PVC well screen. Screen slot size and appropriate filter-pack grade will be determined in the field by a hydrogeologist based upon visual inspection of the formation grain size of the interval to be screened. Typical well construction details are shown on Figure 5-5. A 10-foot length of screen will be used in each well with a filter pack extending not more than one foot below and two feet above the screen. A two foot thick bentonite pellet seal will be placed above the filter pack and cement/bentonite slurry will be tremie-grouted in place above the bentonite seal up to the frost line. The remaining annular space will be sealed with expanding cement and a locking eight-inch steel protective casing will be placed over the riser pipe and seated the cement. A sloped concrete well apron will be constructed around each well. The riser pipe will be caped with a threaded, flanged or compression seal well cap and a one-quarter inch diameter vent hole will be drilled into the casing just below the cap.



MALCOLM PIRNIE

TYPICAL MONITORING WELL CONSTRUCTION DETAIL

MALCOLM PIRNIE, INC

FIGURE 5-5

A permanent surveyor's mark will be placed on the concrete well apron and on the top of the riser for use as measuring points.

Drilling Equipment Decontamination Procedures

To prevent the possibility of cross contamination between boreholes, the work area on the drilling rig and the drilling tools will be thoroughly decontaminated before mobilization and between drilling locations. A pressurized steam cleaner will be used on-site to decontaminate the drilling rig and tools. Steam cleaning will occur on an on-site decontamination pad. Water collected in the decontamination pad sump will be pumped to DOT approved 55-gallon drums or to an on-site tanker. Split-spoon samplers will be decontaminated between each use.

Well Development

Well development improves the hydraulic connection between the well and the saturated zone and removes drill cuttings and fine particles from the well. The well will be developed with a pump to remove clay and other fine particles. During well development, turbidity, pH, specific conductivity and groundwater temperature will be monitored using field equipment. The well will be developed for a minimum of one hour or until the water reaches a turbidity of 50 NTU's and the pH, temperature and conductivity have stabilized to within 10 percent variation between measurements.

Decontamination solutions, drill cuttings, and well development purge water resulting from the installation and development of monitoring wells will be stored on-site in DOT-approved 55-gallon drums or in an on-site tanker. Drums containing cuttings or water will be permanently numbered and an inventory of their contents maintained. The method of disposal will be determined after soil and groundwater analytical results have been obtained. Details on decontamination and storage of materials are discussed in the FSP.

Well Surveying

The new well will be marked with a permanent reference point on the riser and on the well apron. These points will be surveyed for vertical and horizontal control using MSL datum.

Vertical elevations will be surveyed to within 0.01 feet MSL. Vertical elevations to be surveyed include the top of protective casing, top of riser, well aprons, and ground surface. Horizontal locations will be surveyed to within 0.5 feet. Surveyed elevations and locations will be coordinated with the existing well survey. The locations of soil borings and test pits will also be surveyed.

5.3.5.7 Groundwater Sampling

Groundwater sampling will be conducted independently of the sampling schedule proposed by Remedial Engineering/Roux Associates Draft Work Plan and, therefore, will be conducted during Phase II. One round of groundwater sampling is proposed and will consist of sampling a total of 12 wells (six installed by Remedial Engineering/Roux Associates; two installed by MPI; and the four existing wells). The four existing wells (CDM-1 through CDM-4) and the six new monitoring wells (MW-1 through MW-6) will be developed by Remedial Engineering/Roux Associates prior to their groundwater sampling activities. MPI will develop the new wells in the southeastern corner (MW-7) and northwestern corner (MW-8) of the Site. Water levels in all wells will be measured and recorded before purging the well for sampling. Based on existing Site data on water levels, the depth to groundwater is anticipated to be less than 15 feet below ground surface. Given the depth to water, a minimum of three well volumes will be purged from each well, using a centrifugal pump or bailer before collecting the samples. The location of all existing and proposed monitoring wells are shown on Figure 5-4.

Groundwater samples (unfiltered and filtered) will be collected using a stainless steel bailer for laboratory analysis. Descriptions of all purging and groundwater sampling procedures are contained in the Li Tungsten FSP.

The groundwater samples will be analyzed by a non-RAS laboratory for ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U. The groundwater samples from wells MW-7 and MW-8 (installed by MPI) will also be analyzed for TAL/TCL parameters.

5.3.5.8 Air Monitoring

Air monitoring will be conducted for one day during Phase II test pit excavations to measure levels of respirable dust. Monitoring for respirable dust will be also be protective of airborne long-lived particulate radionuclides since the radionuclide concentrations will not reach hazardous levels until the concentration of respirable dust is well above its health-based benchmark. The purpose of the air monitoring is to evaluate contaminant levels in the breathing zone, to select appropriate personal protective equipment, and to use the dust concentration data as a surrogate measure of potential airborne exposure to radiation, as described in the SSHP. If the air monitoring results indicate a need for supplemental monitoring, the USEPA WAM will be consulted.

5.3.5.9 Wetlands/Water Resources

An ecological investigation of the Captain's Cove site will be conducted to characterize existing on-site conditions relative to sensitive resources such as surface waters and wetlands, since the site is adjacent to Glen Cove Creek and Hempstead Harbor. To achieve this goal, and in accordance with Executive Order (EO) 11990, surface waters and wetlands will be defined and identified. A review of existing available site data and base mapping will be conducted. Data that will be acquired and reviewed include USGS, National Wetland Inventory (NWI) mapping, the Soil Survey of Nassau County, and aerial photography. Wetlands will be formally delineated using the "Corps of Engineers Wetlands Delineation Manual" (January, 1987). Data on vegetation, soils, and hydrology will be recorded on the appropriate data forms, wetlands will be identified on site mapping and classified as to type.

While conducting the wetland delineation, observational information for application of the U.S. Army Corps of Engineers Wetlands Evaluation Technique (WET), Version 2.0. WET will be conducted to assess baseline functional values of on-site wetlands. In the event remedial activities will impact wetlands, the baseline values will be utilized to develop a wetland restoration plan.

In conjunction with these activities, vegetation patterns and those areas suitable for wildlife habitat will be identified and mapped. Potential habitat for federal and state threatened and/or endangered species will be identified from on-site observations and available published data.

5.3.5.10 Floodplains

In accordance with EO 11988 (Floodplains Management) and the EPA's "Statement of Policy on Floodplains and Wetlands Policy for CERCLA Actions" (August 5, 19885), a floodplain assessment will be completed for the site. The 100-year and 500-year floodplains will be identified on a site map, and a description of the potential effects of the proposed remedial action on these floodplains will be included. If treatment units or equipment must be located within the floodplain, the assessment will recommend appropriate measures to protect these features against flooding.

5.4 TASK 04 - SAMPLE ANALYSIS/VALIDATION

Due to potential for radiological contamination, all environmental samples collected as part of Task 03, Field Investigations (Section 5.3), will be analyzed through a subcontract for non-RAS laboratory analytical services. This will include all radiological and non-radiological parameters. CLP laboratories will not perform any analyses on these samples because the potential for radionuclides precludes CLP laboratories from accepting the samples. All analytical results will be validated by MPI. The data validation protocols will be in accordance with the USEPA Region II procedures outlined in the Region II CERCLA Quality Assurance Manual for TCL/TAL data (USEPA, 1989d) and the latest update (USEPA, 1992b). The QA/QC procedures outlined in the manual are incorporated into the FSP and QAPjP. Radiological (non-RAS) data will be validated in accordance with the protocols approved by the USEPA Region II for the Li Tungsten Site and modified for Captain's Cove (see Appendix A). The validation program will verify that the analytical results were obtained following the specified protocols, meet the DQOs, and are of sufficient quality to be relied upon in performing the Baseline Risk Assessment, performing the selection and screening of potential remedial action alternatives, and to support a Record of Decision (ROD).

5.4.1 Radiochemical Analysis

As described above in Section 5.3.4, soil/sediment and aqueous samples will be collected for radionuclide analyses. A radioanalytical laboratory will be procured prior to the onset of the field investigations for this task. Samples will be transported to the lab, where they will be analyzed for ^{226}Ra, ^{228}Ra, ^{228}Th, ^{230}Th, ^{232}Th, ^{234}U and ^{238}U. Radium analyses will be done by via gamma spectrometry (by counting the gamma-emitting decay products) and thorium and uranium analyses will be done via radiochemistry/alpha spectrometry.

5.4.2 Chemical Analysis

Approximately half of all soil/sediment samples will also be analyzed by a non-RAS laboratory for TAL/TCL compounds. Soil/sediment samples that are collected in areas of known radioactive contamination (e.g., soils borings, monitoring well borings and test pits in Areas A, B, C, D, E and G) will also be analyzed for TAL/TCL compounds. Samples collected on a site-wide basis in areas that are not known to have radioactive contamination or in areas previously sampled by Roux Associates during the RI/FS (e.g., wetlands sediment samples, site-wide soil borings) will only be analyzed for radionuclides. Selected soil samples that exhibit elevated levels of gamma radiation based on screening with a GM pancake detector will also be analyzed for waste characterization purposes. Chemical analytical parameters for waste characterization including RCRA Characteristics (corrosivity, ignitability, reactivity and TCLP Parameters). All aqueous samples (e.g., groundwater and surface water samples) will be analyzed for both radionuclides and TAL/TCL compounds.

5.4.3 Data Validation

5.4.3.1 Validation of Non-RAS Radiological Data

Samples collected during the field investigation and analyzed through the non-RAS laboratory(ies) for radionuclides will be validated using the USEPA Region II protocols and procedures approved for the Li Tungsten site RI/FS (Appendix A).

5.4.3.2 Validation of Non-RAS Chemical Data

Samples collected during the field investigation and analyzed by a non-RAS laboratory for chemical parameters will be validated using the procedures outlined in the following USEPA Region II documents (and any subsequent updates):

- Laboratory Data Validation, Functional Guidelines for Evaluating Inorganics Analysis, February 1994 Revision (USEPA, 1994b)
- CLP Organics Data Review and Preliminary Review, SOP No. HW-6, Revision No. 11, June 1996 (USEPA, 1996a).
- Evaluation of Metals Data for the CLP, SOP No. HW-2, Revision No. 11, January 1992 (USEPA, 1992c).
- USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review, Multi-media, Multi-concentration (OLM01.0) and Low Concentration Water (OLC02.1), revised 1996. (USEPA, 1996b)

Validation of analytical data will be conducted by personnel trained and certified by USEPA Region II. The results of the data validation will be presented as an appendix to the FFS report.

5.4.4 Field Sampling Plan

The Li Tungsten FSP and QAPjP will be amended to include all samples being collected at the Site. The samples collected during the field investigation will be analyzed for the parameters described in the amended FSP and QAPjP. Detailed information on analytical methods, detection limits and QA/QC samples will be provided in the amended QAPjP. The FSP covers the following topics:

- Site background
- Sampling objectives

- Sample locations, frequency and designation

- Sampling procedures and equipment

- Sample handling

The proposed analytical program includes QA/QC samples required by USEPA Region II, such as duplicates, field blanks, trip blanks and matrix spike/matrix spike duplicates.

5.4.5 Sample Tracking

Sample tracking consists of the arrangements for and allocation to the designated non-RAS laboratory. The task includes assuring proper documentation and transportation of the samples to the laboratories, communication with the non-RAS laboratory and assembly of analytical data packages as they are received.

Sample tracking will include the following activities:

- Selecting procedures to be used by the non-RAS laboratories

- Interacting with the non-RAS laboratory, field personnel and others involved in the sample collection and analysis; and

- Organizing analytical data packages as they are received.

5.5 TASK 05 - DATA EVALUATION

The data collected under Task 03 will be organized and analyzed to permit full assessment of the Site and the nature and extent of radiological contamination in all media and exposure pathways. Previously collected data will be incorporated into this analysis as appropriate to provide a complete site assessment. Previous interpretations will be considered in this analysis but will not be limiting in any way. When possible and as they become available, the evaluation of new data generated by this investigation will be performed concurrently with Tasks 03, 04 and 06, with the goal of expeditiously preparing the Draft FFS Report (Task 11). Assessing the data as it is collected will permit early identification of any data gaps and data quality issues which must be addressed prior to completing the field investigation. If any data gaps or data quality issues are discovered, it will immediately be brought to the attention of the WAM. Response actions will be initiated only with the prior approval of the USEPA.

The **first phase** of data assessment will be performed to identify potential sources of contamination.

The **second phase** will be performed to assess the geology and hydrogeology of the Site. Data from field investigation tasks relating to this assessment will be compiled before initiating the second phase assessment. Features identified during the Surface Investigation will be located on Site maps and described to permit correlation with and impacts to the Site hydrogeology. Geologic logs from the soil boring and monitoring well installation program, and the results of laboratory analyses of the physical characteristics of the soil will be used to construct geologic cross-sections and/or fence diagrams to correlate stratigraphic units across the Site.

Water level data collected from monitoring wells and surface water bodies will be entered into a database in tabular format to allow for the comparison of measurements obtained on different dates and calculation of water elevations. Groundwater and surface water elevations will be plotted on Site maps and groundwater elevation (potentiometric) contours drawn to estimate the direction of groundwater movement. Separate contour maps will be constructed for each water level measurement event for monitoring wells screened in the alluvium and deep monitoring wells screened in the glacial drift deposits.

The **third phase** of data assessment will be performed to assess the nature and extent of the radiological contamination in the various media and exposure pathways at the Site. After data validation, groundwater, surface water, sediment and soil analytical results will be entered into an Excel spreadsheet in tabular format. This will allow for the comparison of measurements obtained on different dates, at different locations and/or in different media. Analytical results will also be compared to the USEPA Office of Research and Development Treatability Study Database to determine if a treatability study should be recommended, as discussed in Section 5.7 of this Draft Final Work Plan. Contaminant concentrations will be mapped and contoured (if appropriate) to illustrate their distribution in the various media across the Site; individual maps will be prepared for distinct hydrogeologic units. The geochemical properties, including breakdown products, of contaminants detected will be considered to help evaluate potential sources of the contaminants and their behavior in the environment. Data from the hydrogeologic characterization of the Site will be integrated with the analytical results of various media to aid in identifying contaminant sources, migration rates and migration routes.

Completion of the data evaluation/assessment will permit development of a refined Site model which will be the basis for the Baseline Risk Assessment performed under Task 6 (Section 5.6). The results of the data evaluation, Site model and Baseline Risk Assessment will be discussed in the Focussed Feasibility Study (FFS) prepared in Tasks 09, 10 and 11 (Sections 5.9 - 5.11 in this Draft Final Work Plan).

Preparation of the data collected during each field investigation task in tables, figures, graphs or maps as described above will facilitate review and evaluation. These tables, figures, graphs, and maps will be submitted to the USEPA for approval of format two months before the Draft FFS Report is submitted. In addition, all original data (such as validated chemical analyses, geologic boring and well construction logs, physical soil sample analyses and water level data) will be presented in appendices to the Draft FFS Report.

5.6 TASK 06 - BASELINE RISK ASSESSMENT

A Baseline Risk Assessment will be conducted to characterize potential human health risks associated with site-related radiological and chemical contamination that would prevail, currently and in the future, in the absence of remedial action. Separate human health evaluations will be conducted for exposure to radiological and chemical contamination following guidance contained in the USEPA's Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual (Part A) (USEPA, 1989a) (RAGS) and other related USEPA guidance. In addition, the human health evaluation for exposure to radiological contamination will include modeling with the computer code RESRAD, Version 5.70 to complement the RAGS methodology and to derive dose-based preliminary remediation goals that correspond to the dose standards set in radiological ARARs. The Baseline Risk Assessment will be included in the FFS report prepared for the investigation of the Site.

Key decision items in the Baseline Risk Assessment process will be communicated to the USEPA for concurrence before proceeding with subsequent steps. As discussed below, key decision items will include:

- the rationale and selection of radionuclides and chemicals of potential concern;
- the potential exposure pathway matrix and inclusion/exclusion analysis;
- the exposure equations and input variables; and
- the toxicity criteria with which to characterize risks.

The human health evaluations will comprise the following components:

Hazard Identification: Radiological and chemical contamination detected in all environmental media sampled during the FFS will be evaluated for selection for detailed analysis. Medium-specific radionuclides and chemicals of potential concern will be selected based on: comparison to background levels; environmental fate, transport, and availability characteristics; and toxicity. The radionuclides and chemicals of potential concern will be representative of the types of contamination present at the Site.

Dose-Response Assessment: Toxicological data for the radionuclides and chemicals of potential concern will be presented, to indicate the intrinsic toxicity of the chemical (i.e., its ability to pose potential hazards to human health). Sources of toxicological data include:

(1) the USEPA Integrated Risk Information System (IRIS); (2) USEPA Health Effects Assessment Summary Tables (HEAST); (3) the USEPA Superfund Technical Support Center; (4) USEPA Federal Guidance Report No. 11, which contain radionuclide-specific dose conversion factors (USEPA, 1988c); and (5) USEPA Federal Guidance Report No. 12, which provides radionuclide-specific dose conversion factors for external radiation exposure (USEPA, 1993). Human health-based toxicity criteria will be tabulated, as appropriate, for later quantitative risk characterization. Brief toxicity profiles will be prepared for those chemicals of potential concern without toxicity criteria, if any, to support qualitative risk characterizations.

<u>Exposure Assessment</u>: Exposure assessments will be conducted to identify actual or potential pathways of human exposure, characterize potentially exposed human populations, and where possible, quantify the exposure of affected populations. Actual or potential exposure pathways, identified by a source and mechanism of radionuclide or chemical release, an environmental transport medium, a point of potential contact, and an exposure route, will be evaluated in the exposure assessment. All potential exposure pathways will be identified and a rationale will be provided for inclusion or exclusion of each pathway.

Potentially exposed populations will be characterized with the intent of determining whether there is potential for casual contact with or intake of the radionuclides or chemicals of potential concern. This characterization will include profiles of the population demographics at each exposure point and identification of human activity patterns which may influence exposure. Under current and future conditions, potential receptors may include trespassers, workers, and residents.

For outdoor occupancy, the potential for ingestion of and direct contact with contaminated soil and building materials may be evaluated. The potential for inhalation of radionuclides and chemicals on respirable particulates may be considered where soil is not covered by buildings or pavement. Where the soil is covered, the potential for exposure to radiation still exists via the external pathway. The potential for incidental contact with groundwater or potential exposure to groundwater during potable use may be evaluated. Indoor occupants may also be exposed via several pathways, including external radiation, ingestion of particulate radionuclides removed from contaminated building surfaces, inhalation of radon decay products and thoron gas, and inhalation of resuspended particulate radionuclides.

Pending the analysis of the analytical data, estimates of exposure point concentrations of the radionuclides and chemicals of potential concern will be determined. The estimates will derive from medium-specific radionuclide and chemical concentrations, activity levels, or exposure rates, or simplified screening model estimates. Where a sufficient number of samples are collected, 95% upper confidence limits on mean concentrations will be calculated and used as exposure point concentrations.

Exposure scenarios will be constructed to quantify hypothetical human exposure levels. Reasonable Maximum Exposure (RME) will be evaluated using standard parameters and assumptions of intake. These values will provide reasonable estimates of exposure and yet not underestimate exposure. All parameters and assumptions will be documented, where possible, by reference to the USEPA guidance and/or the scientific literature.

Risk Characterization: Information from the dose-response assessment and the exposure assessment will be integrated in this step to determine the likelihood, nature and magnitude of human health risks posed by the radionuclides and chemicals of potential concern. The quantitative risk characterization will include evaluation of the potential for increased cancer risks and for adverse non-cancer health effects. Incremental cancer risks will be estimated for exposure to just the radionuclides of potential concern, just the chemicals of potential concern, and to both the radionuclides and chemicals of potential concern. Non-cancer risks will be estimated for the chemicals of potential concern only.

USEPA and State of New York ARARs will form the basis for the evaluation of human health risks associated with exposure to the radionuclides of potential concern at the levels estimated in the exposure assessment. The doses and risks posed by the radionuclides of potential concern will be compared to the unavoidable risk due to exposure to natural background radiation.

Limitations/Uncertainties: Due to data limitations and the number of assumptions used in the human health evaluation process, there is often a considerable amount of uncertainty associated with the risk estimates. A qualitative discussion of the sources and magnitudes of uncertainties inherent in the evaluation process will be presented to address this issue. Central tendency analyses will be conducted for those exposure pathways, exposure routes, or radionuclides or chemicals of potential concern with RME-based risks greater than the USEPA acceptable levels.

5.7 TASK 07 - TREATABILITY STUDY/PILOT TESTING

Treatability studies are not planned at this time, however, may be needed to complete evaluation of potential remedial technologies. Treatability studies are used to determine the performance capabilities of remedial technologies identified as appropriate for a specified contaminated medium. Generally, biologically-based treatment technologies require extensive laboratory analysis in order to be able to predict performance for a site specific application. Chemically-based treatment technologies typically require less rigorous investigation though a treatability study is recommended to develop process kinetics curves. Physically-based technologies often require no treatability studies. Site and media characterization data will be important, but physically-based technologies can usually be directly tested at the field pilot scale.

Data from a treatability study should demonstrate that a given technology will be able to achieve the remedial objectives defined. Data from a treatability study will often be the basis for developing design criteria for a full scale system, and should allow one to predict the rate of removal and the time necessary to reach the desired objective. In addition, treatability studies should identify barriers to attaining clean-up goals for a specific technology, and rate limiting phenomena.

5.8 TASK 08 - REMEDIAL INVESTIGATION (RI) REPORT

Not applicable to scope of work.

5.9 TASK 09 - REMEDIAL ALTERNATIVES - DEVELOPMENT AND SCREENING

This task represents the first phase of the Focussed Feasibility Study (FFS). Its purpose is to develop and select an appropriate range of remedial alternatives to be analyzed more fully in the second phase of the FS, the detailed analysis. The requirements of §300.430(e) of the National Contingency Plan (NCP) and pages 4-3 through 4-28 of the RI/FS guidance document (USEPA, 1988a) shall be adhered to for the development and screening of the remedial action alternatives. Since the development of alternatives is fully integrated with Site characterization activities (Tasks 03 through 06), the following activities will proceed under this task:

- Review the preliminary remedial action objectives [medium-or operable unit-specific goals for protecting human health and the environment (contaminants of potential concern, exposure routes and receptors, acceptable contaminant levels or ranges for exposure routes)] identified in Sections 3.5.1 and 3.5.2;

- Review the preliminary general response actions (medium-specific actions that will satisfy the remedial action objectives), identified in Sections 3.5.1 and 3.5.2;

- Determine whether modifications (e.g., refine, develop, change) to the preliminary remedial action objectives and preliminary general response actions are necessary to conform with the data and information derived from Tasks 03 through 06;

- Delineate the remedial action objectives and general response actions based upon the latter reviews and determinations;

- Identify the volumes or areas of media to which the identified general response actions might be applied (taking into account the requirements for protectiveness);

- Identify and screen the remedial technologies and process options applicable to each general response action (evaluate the universe of potentially applicable technology types and process options with respect to technical implementability in order to eliminate options which cannot be effectively implemented at the Site);

- Evaluate process options using the criteria of effectiveness, implementability, and cost in order to select a representative process for each technology type retained for consideration (technology processes considered implementable are evaluated in greater detail before selecting one process to represent each technology type; one process is selected, if possible, for each technology type, to simplify the development and evaluation of alternatives without limiting flexibility during remedial design);

- Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate (general response actions should be combined using different technology types and different media and/or areas of the Site).

As described below for certain categories of response actions, various ranges of alternatives must be included (the no-action alternative shall be included in every response action category):

- Source control actions will include a range of alternatives in which the principal element is treatment that reduces the toxicity, mobility, or volume of the hazardous substances, pollutants, or as appropriate, this range shall include an alternative that removes or destroys hazardous substances, pollutants, or contaminants to the maximum extent feasible, eliminating or minimizing extent feasible, eliminating or minimizing, to the degree possible, the need for long-term management. Other alternatives will be developed which, at a minimum, treat the principal threats but vary in the degree of treatment and the quantities and characteristics of the treatment residuals and untreated waste that must be managed. One or more alternatives will be developed which provide little or no treatment, but provide protection of human health and the environment by preventing or controlling exposure to hazardous substances, pollutants, or contaminants, through engineering controls.

- Groundwater actions will include a limited number of alternatives that attain site-specific remediation levels within different restoration time periods utilizing one or more different technologies.

In addition, and to the extent sufficient information is available, the short and long term aspects of the following three criteria shall be used to screen the defined remedial alternatives:

- Effectiveness - the degree to which an alternative reduces toxicity, mobility, or volume through treatment, minimizes residual risks, and affords long term protection, complies with ARARs, minimizes short term impacts, and time to achieve protection;

- Implementability - the technical feasibility and availability of the technologies each alternative would employ and the administrative feasibility of implementing the alternative; and

- Cost - the costs of construction and any long term costs to operate and maintain the alternatives.

Information available at the time of screening will be used primarily to identify and distinguish any differences among the various alternatives and to evaluate each alternative with respect to its effectiveness, implementability, and cost. Alternatives with the most favorable composite evaluation of all factors shall be retained for further consideration during the detailed analysis. However, alternatives selected for detailed analysis should, where practicable, preserve the range of treatment and containment technologies initially developed.

Innovative technologies are technologies which are fully developed but lack sufficient cost or performance data. If any innovative technologies are defined and are determined to offer: the potential for comparable or superior performance or implementability; fewer or lesser adverse impacts than other available approaches; or lower costs for similar levels of performance than demonstrated treatment technologies; then such innovative technologies shall be carried through the screening phase.

5.10 TASK 10 - DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

This task represents the second phase of the FFS. Its purpose is to evaluate the alternatives carried through the screening phase of the FFS in order to provide the basis for identifying a preferred alternative for remedial action. The detailed analysis will consist of the following components:

- Identification and further definition (details) of the alternatives selected from the screening phase (including details on volumes or areas of contaminated media to be addressed, the technologies to be used, and any performance requirements associated with the technologies);

- An assessment and a summary profile of each alternative against the nine evaluation criteria; and

- A comparative analysis among the alternatives to assess the relative performance of each alternative with respect to each evaluation criterion.

The performance of this task shall be conducted in conformance with the methodology identified in the RI/FS guidance document (USEPA, 1988a) and the conditions specified under 300.430(e) of the NCP (March 1990).

5.11 TASK 11 - FOCUSSED FEASIBILITY STUDY (FFS) REPORT AND POST FFS SUPPORT

A Draft FFS Report shall be prepared and written in accordance with the RI/FS guidance document (USEPA, 1988a) and the format specified on page 6-15 of that document. The submission date of the draft FFS Report shall be determined at the FFS alternative screening meeting. Following receipt of USEPA comments, the report shall be revised and resubmitted to the USEPA within an estimated schedule of four weeks. A Draft FFS Report does not become "Final" until the public comment period has ended and public comments on the report, if received, are incorporated. Upon approval by the USEPA, the report shall be deemed "Final FFS Report."

This task includes efforts to prepare the public comment responsiveness summary, support the ROD, conduct any predesign activities and close out the work assignment. All activities occurring after the release of the FFS to the public, other than reviewing/finalizing the FFS itself, should be reported under this task. The following are typical activities:

- Preparing the predesign report
- Preparing the conceptual design
- Attending public meetings
- Writing and reviewing the responsiveness summary

- Supporting ROD preparation and briefings

- Reviewing and providing QC of the work effort

- Providing task management and QC

5.12 TASK 12 - PROJECT CLOSEOUT

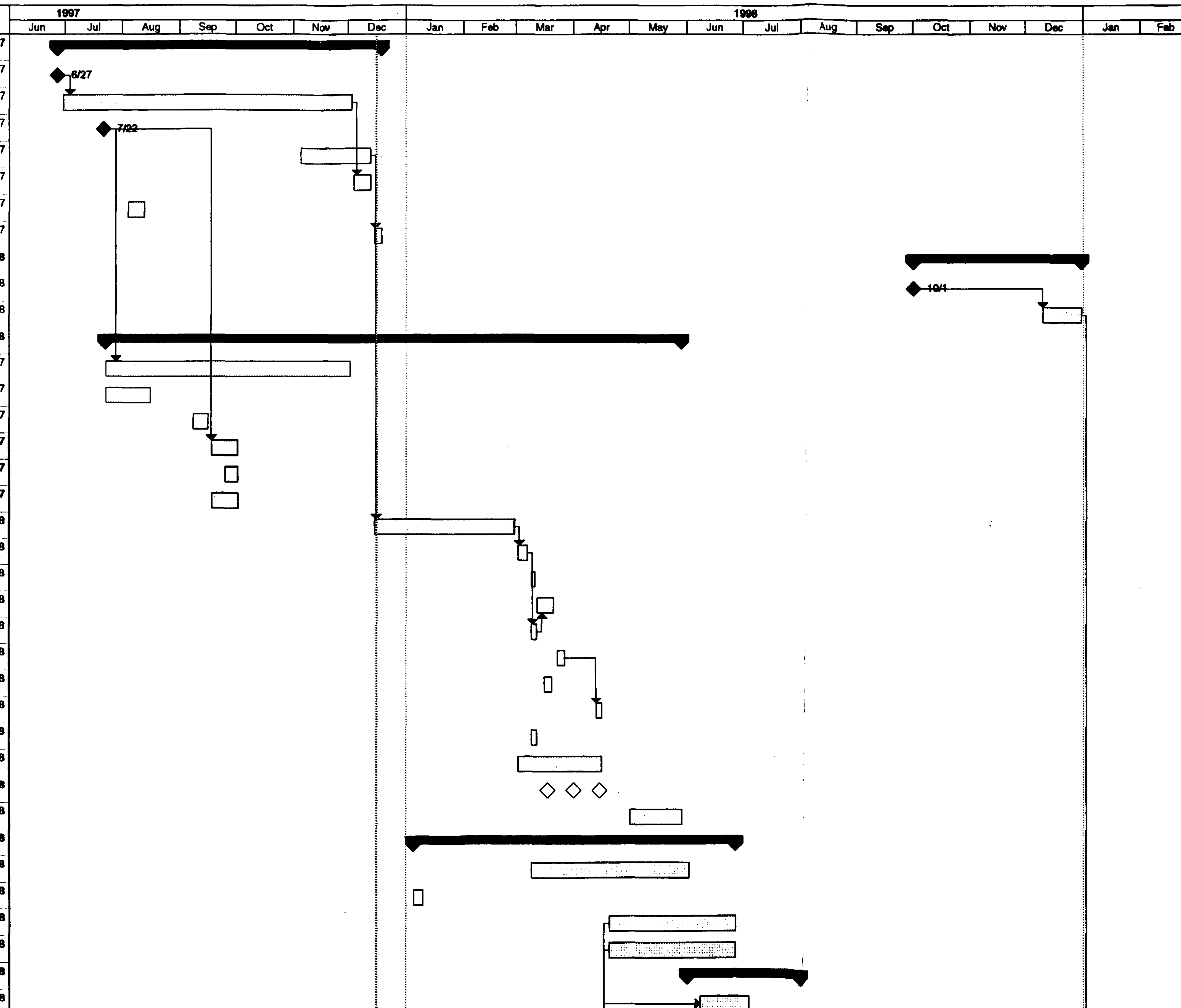
At the completion of all activities under this work assignment, a Work Assignment Completion Report (WACR) will be prepared and submitted in accordance with the USEPA Region II requirements and standard operating procedures.

6.0 SCHEDULE

The schedule for the Captain's Cove FFS is provided in Figure 6-1.

CAPTAIN'S COVE FFS SCHEDULE
WA# 025-2L4L

ID	Task Name	Duration	Start	Finish
1	**PROJECT PLANNING**	125d	Fri 6/27/97	Thu 12/18/97
2	Submit Draft Work Plan/Cost Estimate	0d	Fri 6/27/97	Fri 6/27/97
3	USEPA Review and Comment	112d	Mon 6/30/97	Tue 12/2/97
4	Interim Approval for Phase I Activities	0d	Tue 7/22/97	Tue 7/22/97
5	USEPA Approval of Cost Estimate	28d	Wed 11/5/97	Fri 12/12/97
6	Submit Final Work Plan	7d	Thu 12/4/97	Fri 12/12/97
7	Revise/Update FSP/QAPjP/HASP - Phase I Activities	7d	Mon 8/4/97	Tue 8/12/97
8	Revise/Update FSP/QAPjP/HASP - Phase II Activities	4d	Mon 12/15/97	Thu 12/18/97
9	**COMMUNITY RELATIONS**	65d	Thu 10/1/98	Wed 12/30/98
10	Public Meeting	0d	Thu 10/1/98	Thu 10/1/98
11	Prepare Proposed Plan	15d	Thu 12/10/98	Wed 12/30/98
12	**FIELD INVESTIGATION**	222d	Wed 7/23/97	Thu 5/28/98
13	Coordination with RI/FS Consultant	94d	Wed 7/23/97	Mon 12/1/97
14	Phase I - Subcontractor Procurement	18d	Wed 7/23/97	Fri 8/15/97
15	Phase I - Mobilization/Demobilization	6d	Mon 9/8/97	Mon 9/15/97
16	Phase I - Radiation Screening	10d	Thu 9/18/97	Wed 10/1/97
17	Phase I - Gamma Logging	5d	Thu 9/25/97	Wed 10/1/97
18	Phase I - Soil Sample Collection	10d	Thu 9/18/97	Wed 10/1/97
19	Phase II - Subcontractor Procurement	55d	Mon 12/15/97	Fri 2/27/98
20	Phase II - Mobilization/Demobilization	5d	Mon 3/2/98	Fri 3/6/98
21	Phase II - Surface Gamma Survey	2d	Mon 3/9/98	Tue 3/10/98
22	Phase II - Soil Borings/Gamma Logging	7d	Thu 3/12/98	Fri 3/20/98
23	Phase II - Test Pits	3d	Mon 3/9/98	Wed 3/11/98
24	Phase II - Monitoring Well Installation	4d	Mon 3/23/98	Thu 3/26/98
25	Phase II - Surf./Storm Water/Sed/Wetland Sampling	4d	Mon 3/16/98	Thu 3/19/98
26	Phase II - Groundwater Sampling	3d	Mon 4/13/98	Wed 4/15/98
27	Phase II - Air Monitoring	3d	Mon 3/9/98	Wed 3/11/98
28	Phase II - RSCC Coordination	33d	Mon 3/2/98	Wed 4/15/98
29	Field Audits	20d	Wed 3/18/98	Wed 4/15/98
33	IDW Disposal	20d	Fri 5/1/98	Thu 5/28/98
34	**SAMPLE ANALYSIS AND DATA VALIDATION**	125d	Mon 1/5/98	Fri 6/26/98
35	Laboratory Analysis	61d	Mon 3/9/98	Mon 6/1/98
36	Modify Radiological Validation Protocols	5d	Mon 1/5/98	Fri 1/9/98
37	Data Validation - Chemical Data	50d	Mon 4/20/98	Fri 6/26/98
38	Data Validation - Radiological Data	50d	Mon 4/20/98	Fri 6/26/98
39	**DATA EVALUATION**	45d	Mon 6/1/98	Fri 7/31/98
40	Develop Database Files	20d	Mon 6/8/98	Fri 7/3/98



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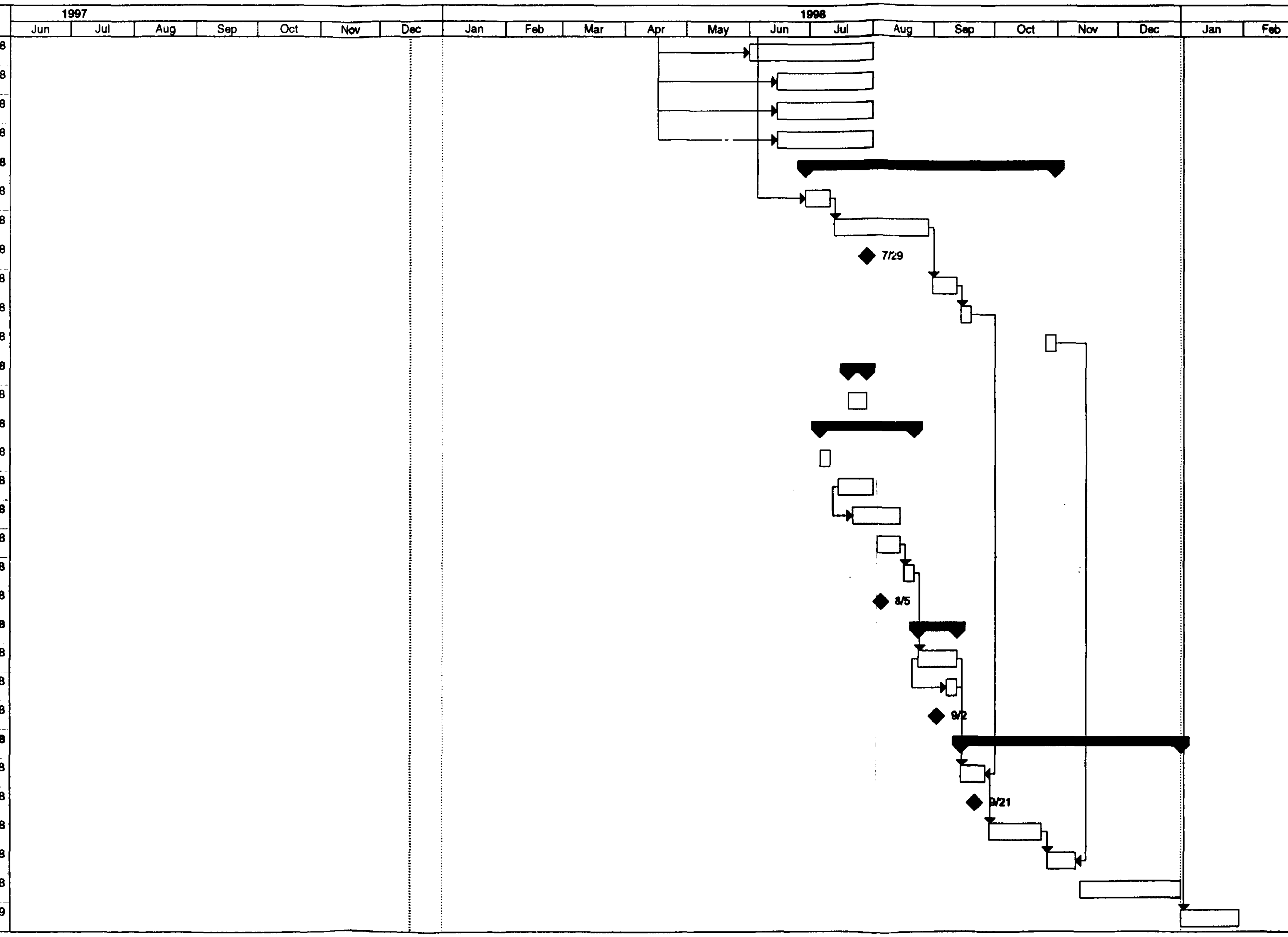
CAPTAIN'S COVE FFS SCHEDULE
WA# 025-2L4L

ID	Task Name	Duration	Start	Finish
41	Eval. of Soil/Sediment Data	45d	Mon 6/1/98	Fri 7/31/98
42	Eval. of Groundwater/Surface Water Data	35d	Mon 6/15/98	Fri 7/31/98
43	Eval. of Air Monitoring Data	35d	Mon 6/15/98	Fri 7/31/98
44	Eval of Waste Characterization Data	35d	Mon 6/15/98	Fri 7/31/98
45	**ASSESSMENT OF RISK**	**90d**	**Mon 6/29/98**	**Fri 10/30/98**
46	Pathways Analysis Report	10d	Mon 6/29/98	Fri 7/10/98
47	Human Health Risk Assessment	7w	Mon 7/13/98	Fri 8/28/98
48	Technical Review Meeting	0d	Wed 7/29/98	Wed 7/29/98
49	USEPA Review and Comment	10d	Mon 8/31/98	Fri 9/11/98
50	Draft Risk Assessment Report	5d	Mon 9/14/98	Fri 9/18/98
51	Final Risk Assessment Report	5d	Mon 10/26/98	Fri 10/30/98
52	**TREATABILITY STUDIES**	**7d**	**Mon 7/20/98**	**Tue 7/28/98**
53	Determination of Need	7d	Mon 7/20/98	Tue 7/28/98
54	**DEVELOP/SCREEN ALTERNATIVES**	**35d**	**Mon 7/6/98**	**Fri 8/21/98**
55	Remedial Action Objectives Report	5d	Mon 7/6/98	Fri 7/10/98
56	Screening of Alternatives	13d	Wed 7/15/98	Fri 7/31/98
57	Development of Alternatives	18d	Wed 7/22/98	Fri 8/14/98
58	Preliminary Cost Estimates	10d	Mon 8/3/98	Fri 8/14/98
59	Screening of Alternatives Report	5d	Mon 8/17/98	Fri 8/21/98
60	Technical Review Meeting	0d	Wed 8/5/98	Wed 8/5/98
61	**DETAILED ANALYSIS OF ALTERNATIVES**	**15d**	**Mon 8/24/98**	**Fri 9/11/98**
62	Analysis of Selected Alternatives	15d	Mon 8/24/98	Fri 9/11/98
63	Detailed Cost Estimates	5d	Mon 9/7/98	Fri 9/11/98
64	Technical Review Meeting	0d	Wed 9/2/98	Wed 9/2/98
65	**FFS REPORT/POST FFS SUPPORT**	**79d**	**Mon 9/14/98**	**Thu 12/31/98**
66	Draft FFS Report	10d	Mon 9/14/98	Fri 9/25/98
67	Technical Review Meeting	0d	Mon 9/21/98	Mon 9/21/98
68	USEPA Review and Comment	4w	Mon 9/28/98	Fri 10/23/98
69	Final FFS Report	10d	Tue 10/27/98	Mon 11/9/98
70	Post FFS Support	36d	Thu 11/12/98	Thu 12/31/98
71	**PROJECT CLOSEOUT**	**21d**	**Fri 1/1/99**	**Fri 1/29/99**



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7.0 PROJECT MANAGEMENT APPROACH

7.1 ORGANIZATION AND APPROACH

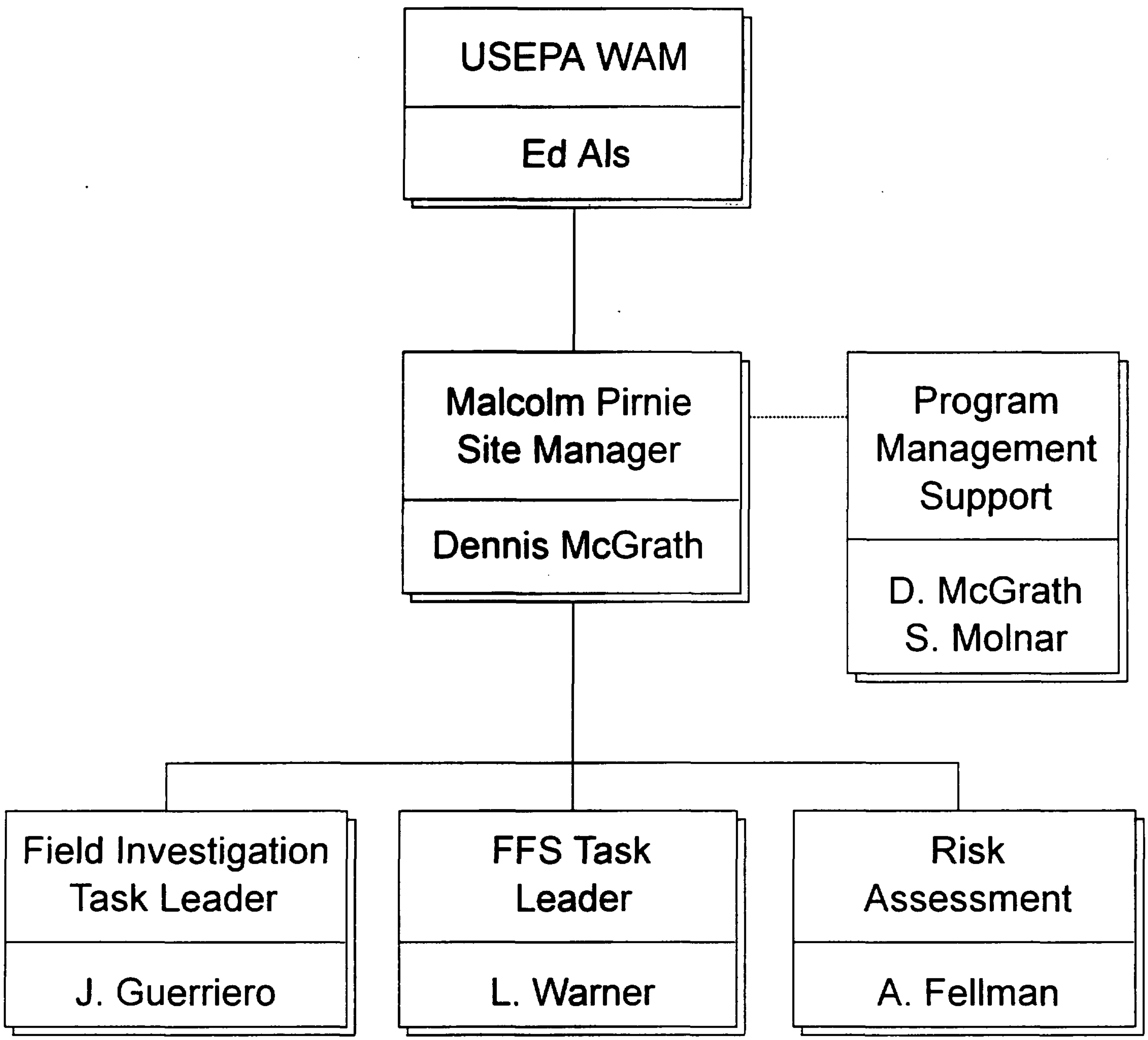
The Site Manager (SM) for the FFS will manage the day-to-day technical and financial aspects of the project and will interact directly with the USEPA Work Assignment Manager (WAM). The SM will manage all aspects of the project from work planning through completion of the FFS report and project close-out. The SM has primary responsibility for plan development and implementation of the FFS, including coordination among the task leaders and support staff, acquisition of engineering or specialized technical support, and other aspects of the day-to-day activities associated with the project. The SM identifies staff requirements, directs and monitors progress, assures implementation of quality control procedures and is responsible for performance within the established budget and schedule. A project organization chart along functional lines for the Captain's Cove FFS is presented in Figure 7-1.

The project team members are selected for their qualifications and experience with the technical issues to be addressed at the Site. If unanticipated site problems or project needs are encountered that cannot be adequately handled by this team, technical experts from other offices within USEPA Region II will be used as necessary.

The Site Quality Assurance Coordinator working with the SM and task leaders, is responsible for ensuring that appropriate QC procedures are implemented, including acquisition of field equipment and supplies, development of the QAPjP, reviews of specific tasks, QC procedures and field sample management. A Quality Assurance Audit will be performed by the Program QA Manager who is independent of the SM's reporting structure.

The Field Investigation Task Leader will work directly with the SM to develop the FSP and will be responsible for the implementation of the field investigation, interpretation and presentation of data acquired and preparation of that data in the final FFS Report. The Field Investigation Task Leader is also responsible for on-site management for all site operations,

Project Organization
Captain's Cove FFS
Glen Cove, NY



including the work performed by subcontractors, such as well drilling and gamma surveying. The Field Investigation Task Leader will consult with the SM and decide on issues relating to sampling activities and changes to the field sampling program.

The FS Task Leader will work closely with the Field Investigation Task Leader to ensure that the field investigation generates the proper type and quantity of data for use in the initial screening of remedial technologies/alternatives (Task 09), detailed evaluation of remedial alternatives (Task 10), and associated cost analysis. The FFS Report (Task 11) will be developed by a technical subgroup under the direction of the FFS Task Leader.

The Regional Sample Coordinator will ensure compliance with the USEPA Regional Sample Control Center (RSCC) requirements for non-RAS laboratory services and analyses as described in the FSP. The sample coordinator will be coordinate with the Field Investigation Task Leader to ensure that samples are properly collected, preserved, packaged, and shipped in accordance with USEPA guidelines. The sample coordinator is also responsible for data validation.

Program Management (PM) support will entail overall management of schedules, expenditure limit, subcontracting, and liaison with the USEPA CO and PO. The ARCS II Equipment Manager will be responsible for the mobilization of field equipment and supplies.

7.2 COORDINATION WITH USEPA

The SM is responsible for coordinating the project with the WAM. Weekly telephone contact will be maintained to provide updates on project status. All coordination activities with the NYSDEC and the Consultant for the City of Glen Cove (Roux Associates) will be through the USEPA, although direct contact between the SM and NYSDEC and Roux Associates may be maintained, if required and approved by the USEPA. A log of any direct communication with the NYSDEC and Roux will be maintained.

7.3 SCHEDULE CONTROL

As the project proceeds, the SM will monitor actual progress against the schedule outlined in this Work Plan, and deliverable due dates on a bi-weekly basis and update them, as necessary. The USEPA standard RI/FS task numbering system for the work effort is described in Section 5 of this Draft Final Work Plan. Each of these tasks has been scheduled and will be tracked separately during the FFS. The SM will inform the WAM of any known or anticipated change of project elements. If a delay occurs or is anticipated, the SM will develop and outline available methods to maintain the overall project schedule. Progress meetings will be held, as needed, to evaluate project status, discuss current items of interest, and review major deliverables such as the FSP, SSHP, and the FFS reports.

7.4 QUALITY ASSURANCE

The QAPjP will be in accordance with the Quality Assurance Program Plan (QAPP) as approved by the USEPA. Work on this assignment will be conducted in accordance with the procedures defined in the site-specific FSP and QAPjP. These documents are included under separate cover. Field blanks, field replicates, trip blanks and samples for laboratory spiking and duplicates will be submitted to the laboratory as outlined in the QAPjP. The desired precision and accuracy of laboratory and field data will be documented in the QAPjP. Laboratory data will be validated in accordance with Region II data validation guidelines.

Deliverables will be reviewed by the quality control review team assigned to this project. The SM will coordinate these reviews and will promote frequent progress reviews during the project. The comments of the review team will be incorporated into the deliverables before review drafts are submitted to USEPA. Field operations will be audited by the PM QA Manager.

7.5 LABORATORIES

Samples collected for chemical analysis will be analyzed by non-RAS laboratories procured through competitive bids. The SM will check with the USEPA's ESD laboratory to see if ESD can perform the required analysis before a non-RAS laboratory is procured. Based on our knowledge of the Superfund process and the Site, the project team assigned to work on the Site will:

- Submit only the number of samples to non-RAS laboratories that are necessary to meet DQOs.
- Request analyses of only those compounds needed to meet the DQOs, tailoring analyses to site-specific conditions, as necessary.
- Maintain sample shipment schedules to promote an orderly progression of samples into the non-RAS laboratories.

The status of analyses to be performed by non-RAS laboratories will be monitored by the SM and potential delays will be reported directly to the USEPA WAM.

7.6 COORDINATION WITH OTHER AGENCIES

Field investigation activities at the Site will require coordination among numerous federal, state, and local agencies and coordination with involved private organizations. Coordination activities with these agencies are as described below.

7.6.1 Federal Agencies

USEPA is responsible for overall direction and approval of all activities for the Captain's Cove FFS. Sources of technical information are such agencies as USEPA, U.S. Army Corps of Engineers (USACOE), Agency for Toxic Substances and Disease Registry (ATSDR), U. S. Geological Survey (USGS), USEPA Laboratories - Edison, U.S. Department of Interior, and National Oceanic and Atmospheric Administration (NOAA). These sources will be accessed through the WAM for background information on the Site and surrounding areas.

7.6.2 State Agencies

The state, through NYSDEC, may provide review, direction, and input for the FFS. The WAM will coordinate contacts with NYSDEC.

7.6.3 Local Agencies

Local agencies that may be involved include the City of Glen Cove departments such as Mayor's office, planning boards, zoning and building commissions, police, and fire department. Contacts with these local agencies will be coordinated through the WAM.

7.6.4 Private Organizations

Private organizations requiring coordination during the RI/FS include PRPs, the community task force, other concerned residents in the area, and public interest groups such as environmental organizations and the press. Coordination with these interested parties will be through the WAM.

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9.0 GLOSSARY OF ABBREVIATIONS AND ACRONYMS

ABBREVIATIONS

ACGIH	American Conference of Governmental and Industrial Hygienists
AEA	Atomic Energy Act of 1954
ALARA	As Low As Reasonably Achievable
ARARs	Applicable or Relevant and Appropriate Requirements
ARCS	Alternative Remedial Contracting Strategy
ASTM	American Society of Testing Materials
ATSDR	Agency for Toxic Substance and Disease Registry
BEIR	Committee on the Biological Effects of Ionizing Radiation
Bq	Becquerel
BNA	Base-Neutral/Acid Extractables
BOD	Biological Oxygen Demand
CAA	Clean Air Act
CDI	Chronic Daily Intakes
CDM	Camp Dresser & McKee, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	Code of Federal Regulation
Ci	Curie
CLP	Contract Laboratory Program
cm	Centimeter
CMA	Chemical Manufacturer's Association
CO	Contracting Officer (USEPA)
COD	Chemical Oxyen Demand
CPF	Carcinogenic Potency Factor
CRQL	Contract Required Quantification Limit
dpm	Disintegrations per minute
DOE	U.S. Department of Energy

DOT	U.S. Department of Transportation
DQO	Data Quality Objectives
EA	Ecological Assessment
FAR	Federal Acquisition Regulation
FFS	Focussed Feasibility Study
FRC	Federal Radiation Council
FS	Feasibility Study
FSP	Field Sampling Plan
FUSRAP	Formerly Utilized Sites Remedial Action Program
GCDC	Glen Cove Development Corporation
GM	Geiger Mueller
Gr	Gray
Hart	Fred C. Hart Associates, Inc.
HEAST	Health Effects Assessment Summary Tables
ICRP	International Commission on Radiological Protection
IDL	Instrument Detection Limit
IRIS	Integrated Risk Information System
LLRWPA	Low Level Radioactive Waste Policy Act
LSA	Low Specific Activity
MCLs	Maximum Contaminant Levels
MCLGs	Maximum Contaminant Level Goals
MeV	Mega-electron Volts
MPI	Malcolm Pirnie, Inc.
mrem	millirem
mR/h	milliRoentgen per hour
MSL	Mean Sea Level
NAAQS	National Ambient Air Quality Standards
NaI	Sodium Iodide
NAPL	Non Aqueous Phase Liquid
NAS	National Academy of Sciences

NCDOH	Nassau County Department of Health
NCP	National Contingency Plan
NCRP	National Council on Radiation Protection and Measurements
NDL	The NDL Organization, Inc.
NESHAPs	National Emission Standards for Hazardous Air Pollutants
NOAA	National Oceanic and Atmospheric Administration
non-RAS	non - Routine Analytical Services
NORM	Naturally Occurring Radioactive Material
NPDES	National Pollution Discharge Elimination System
NPL	National Priorities List
NRC	Nuclear Regulatory Commission
NUREG	Nuclear Regulatory Commission Regulation
NWI	National Wetland Inventory
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OSHA	Occupational Safety and Health Administration
OSWER	Office of Solid Waste and Emergency Response (USEPA)
OVA	Organic Vapor Analyzer
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
pCi/g	picoCurie per gram
pCi/L	picoCurie per Liter
PIC	Pressurized Ion Chamber
PLM	Polarizing Light Microscopy
POTW	Publicly-Owned Treatment Works
PRP	Potentially Responsible Party(ies)
PVC	Polyvinyl chloride
QA	Quality Assurance
QAPjP	Quality Assurance Project Plan

QC	Quality Control
R	Roentgen
Ra	Radium
RAS	Routine Analytical Services
RCRA	Resource Conservation and Recovery Act
rem	rem
RfD	Reference Dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	Reasonable Maximum Exposure
RMPP	Radon Measurement Proficiency Program
Rn	Radon (gas)
ROD	Record of Decision
RSCC	Regional Sample Control Center
SARA	Superfund Amendments and Reauthorization Act of 1986
SAS	Special Analytical Services
SBE	Small Business Enterprise
SDBE	Small Disadvantaged Business Enterprise
SDWA	Safe Drinking Water Act
SFMP	Remote Surplus Facilities Management Program
SM	Site Manager
SMO	Sample Management Office
SOP	Standard Operating Procedure(s)
SOW	Statement of Work
SPT	Standard Penetration Test
SPDES	State Pollution Discharge Elimination System
SSHP	Site Safety and Health Plan
SSI	Site Screening Inspection
Sv	Sievert
SVE	Soil Vapor Extraction

TAGM	Technical Administrative Guidance Memorandum
TAL	Target Analyte List
TBC	"To Be Considered" Material
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure
TDS	Total Dissolved Solids
TEM	Transmission Electron Microscopy
Th	Thorium
TLV	Threshold Limit Value
TOC	Total Organic Carbon
TSS	Total Suspended Solids
TSCA	Toxic Substance Control Act
μg/Kg	microgram per Kilogram
μg/L	microgram per Liter
μR/h	microRoentgen per hour
U	Uranium
UMTRCA	Uranium Mill Tailing Radiation Control Act
USACOE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
USNRC	United States Nuclear Regulatory Commission
VOC	Volatile Organic Compounds
WACR	Work Assignment Completion Report
WAF	Work Assignment Form
WAM	Work Assignment Manager
WET	Wetlands Evaluation Technique
WL	Working Level

APPENDIX A

DATA VALIDATION PROTOCOLS FOR RADIOLOGICAL DATA

RADIOLOGICAL DATA REVIEW AND VALIDATION GUIDELINES

ISOTOPIC ANALYSES BY ALPHA SPECTROMETRY

LI TUNGSTEN - CAPTAIN'S COVE ADJUNCT
FOCUSSED FEASIBILITY STUDY

Scope and Applicability

This document provides guidance for the review of laboratory data packages and the validation of analytical results for alpha particle emitting radionuclides from samples collected during the Captain's Cove Focussed Feasibility Study (FFS) generated via radiochemical separation/alpha spectrometry.

Currently, there are no standard methods for radiological data evaluation or validation that are equivalent to the U. S. Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) methods for chemical data. This document suggests areas for review of data packages and acceptance limits for the assessment and validation of radiochemistry results, based on accepted nuclear industry standards and draft data validation protocols used at Department of Energy (DOE) sites.

Purpose

The purpose of review and validation is to assure that the quality of each data point is known, and that each data point is flagged with a qualifier indicating the quality of that data point. In addition, data validation provides a review of laboratory quality control (QC) measures so that corrections to laboratory procedures can be implemented if necessary. This procedure provides guidelines for review and validation of radioanalytical data packages, and establishes criteria for applying appropriate data qualifiers to individual data points.

Criteria

The criteria used to evaluate data are based on the examination of sample holding time, instrument calibration, calibration verification, laboratory control and matrix spike analysis, duplicate analysis, blank analysis, radiochemical yield analysis, and quantitative review.

The laboratory will participate in an interlaboratory comparison crosscheck program (such as those operated by the USEPA, DOE's Environmental Measurements Laboratory, etc.). If the laboratory does not participate in such a program, or has not passed its most recent round of intercomparison measurements, all data will be flagged "unusable" (R).

Holding Times

All aqueous samples should be preserved to pH $\leq$ 2 and must be analyzed within 180 days of the sample collection.

Actual holding times are established by comparing the sampling date on the sample traffic report with the date of analysis found in the laboratory data (digestion logs and instrument run logs).

Analyte Holding Time (days) = Analysis Date - Sampling Date [Note: The holding time is calculated from the date of collection, rather than the verified time of sample receipt. It is a technical, not a contractual, requirement.]

If the holding time requirements are not met, qualify sample results < MDC "UJ". Sample results $\geq$ MDC may not require qualification; however, "J" may be designated, if necessary. If holding times are > 360 days, reject all associated data.

Due to limited information concerning holding time of soil samples, it is left to the discretion of the data reviewer to determine whether to apply the holding time criteria for aqueous samples to solid samples. Solids data qualified based on the criteria established for aqueous samples must be documented in the data validation report.

Detector Calibration

Instrument Calibration

For alpha particle measurements, the detectors must be calibrated to obtain the counting efficiency for each of the radionuclides with a standard traceable to the National Institute of Standards and Technology (NIST). NIST certificates for all calibration standards including a dilution log documenting the preparation dates, lot numbers, activity, expiration dates, and volume of standards used must be provided. Each detector will be calibrated per manufacturer's instructions with an alpha standard representative of the target radionuclides within one year of the analysis date.

Energy calibration will be generated by plotting peak centroids vs. energy. Efficiency calibration will be performed over a range of energies, i.e., approximately 3 - 7 MeV. The efficiency for a given region of interest (ROI) is calculated as follows:

$$Efficiency = \frac{C_s - B}{D}$$

where:

C_s	=	gross count rate in the ROI corresponding to the energy of the standard, cpm
B	=	background count rate in the ROI corresponding to the energy of the standard, cpm
D	=	disintegration rate of the standard, dpm

The system resolution is the product of system gain (keV/channel) and the Full Width at Half Maximum (FWHM in channels). The initial resolution (in keV) will be provided for each detector. Results for all samples analyzed on an instrument that was not properly calibrated will be flagged "estimated" (J).

Calibration Verification

A calibration verification will be performed weekly with an independently prepared verification standard. Alpha spectrometers require a weekly energy vs. channel calibration verification with a source having at least two alpha emitters. The measured energy calibration verification values for the two alpha peaks should be within $\pm$ 100 keV of the initial energies determined at the time of calibration. The results from any detector where the energies are not within $\pm$ 100 keV of the calibrated values will be flagged "estimated" (J).

The detector efficiencies must also be monitored weekly. The measured efficiency should be within control limits of $\pm$ 10 percent of the initial counting efficiency. Results for samples analyzed after a verification beyond control limits and before the next adjacent acceptable verification will be flagged "estimated" (J). If the calibration verification was not performed, all results will be flagged "estimated" (J).

Weekly verification of detector resolution will be performed. Resolution for peaks of interest should remain within ± 25 keV or all results will be flagged "estimated" (J).

Detector Background

Backgrounds should be run on each detector at least monthly for alpha spectrometer systems, for a minimum of 1000 minutes. The background should be tracked by comparing the total counts over the entire spectrum. It should be within ± 3 standard deviations of the historical background. In addition, the background spectra should be reviewed for the presence of any peaks not normally associated with a background count. The mean background count rate in the appropriate regions of interest, or the data needed to calculate the mean background count rate, must be provided. If backgrounds were not run, or resulted in count rates outside of the control limits, all associated sample results will be flagged "estimated" (J).

Tracer Analysis - Radiochemical Recovery

Tracer analysis is required to determine radiochemical recovery (yield). The tracer used should have chemical behavior similar to the target radionuclides. For most procedures, the recovery is determined using an isotope of the analyte of interest (e.g., Th-229, U-232). The tracer isotope is one that is not expected to occur in the samples analyzed. Each sample will be traced. Untraced samples will be flagged "unusable" (R).

Tracer certification will be provided by the laboratory in the data package. In its absence, all data will be flagged "estimated" (J). Tracer solutions should be prepared no more than two years prior to the sample analysis date. If this criterion has been exceeded, all data will be flagged "unusable" (R).

The quantity of tracer used should be adequate to provide a maximum of 10 percent uncertainty at the 95 percent confidence level in the measured recovery. The percent recovery, or yield, is calculated as follows:

$$Recovery = \frac{C_t}{t x A_t x E}$$

where:

C_t	=	net sample counts in the ROI corresponding to the tracer, cpm
t	=	sample count time, minutes
A_t	=	activity of tracer added, dpm
E	=	counting efficiency in ROI

The following limits for radiochemical recovery will be used:

- 30 - 110 percent: Acceptable
- > 110 - 150 percent: Estimated (J)
- 20 - 30 percent: Estimated (J)
- < 20 percent, > 150 percent: Unusable (R)

Quality Control Samples

Quality control (QC) requirements include analyses of method blanks, laboratory control samples (LCS), duplicates, and matrix spikes at a frequency of one of each QC sample type per each batch of 20 samples. They should be performed in like geometries, with similar count times, and on the same dates which the samples in the applicable batch are analyzed. If these parameters cannot be verified, the data will be flagged "estimated" (J).

Blank Samples

Blanks are used to determine background counts due to environmental and reagent radiation sources. High blank sample results may also indicate the presence of laboratory or counter contamination.

The results for all blanks should be less than or equal to the MDC and contract-required detection limit (CRDL). If radionuclides are detected in blanks, then sample results for the same radionuclides should be considered as positive only if they exceed 5 times the blank concentration. Samples that show positive results less than 5 times the blank values (for radionuclides detected in blanks) will be qualified as estimated (J).

The results for all blanks will be recorded on a control chart. Control limits should be set at three standard deviations from the mean for each chart. If the blank result falls outside the appropriate control limit, then the set of sample results covered by the blank will be flagged "estimated" (J).

If a radionuclide is found in a blank but not in the sample, it may be an indication of a mislabelled sample or other error. This should be looked into by laboratory personnel.

Laboratory Control Samples (Blank Spikes)

Laboratory control samples (LCS) will be analyzed for each target isotope for each sample matrix. They usually consist of deionized water or silica sand which have been spiked with a known concentration of a radionuclide of interest. The LCS provide an indication of laboratory accuracy. Control charts should be constructed to monitor control limits. A minimum of 20 data points should be used to calculate control limits, set at $\pm$ 3 standard deviations about the mean. In the absence of this information, acceptance criteria may be set at:

- Water — 80-120 percent of known value
- Soil and sediments — 70-130 percent of known value

All values associated with a LCS beyond the appropriate acceptance criterion will be flagged "estimated" (J).

Duplicate Samples

A laboratory duplicate is a separate and equal aliquot of a homogenized sample. The duplicate samples provide an indication of laboratory precision.

A control limit of $\pm$ 20 percent for water samples and $\pm$ 35 percent for soil and sediment samples for the relative percent difference (RPD) shall be used for sample values >5x the CRDL.

A control limit of ± CRDL for water samples and ± 2x CRDL for soil and sediment samples shall be used for sample values <5x the CRDL.

The RPD is calculated as follows:

$$RPD = \frac{|S-D|}{(S+D)/2} x 100$$

where:

S	=	First sample value (original)
D	=	Second sample value (duplicate)

Verify that the field blank was not used for duplicate analysis. If the field blank was used for duplicate analysis, all other QC data must be carefully checked and professional judgment exercised when evaluating the data.

If duplicate analysis results for a particular radionuclide fall outside the appropriate control windows, qualify the results for that radionuclide in all associated samples of the same matrix as "estimated" (J).

Matrix Spikes

Matrix spike samples are samples spiked so that interferences caused by the sample matrix may be evaluated. They are prepared for each matrix analyzed. The matrix spike percent recovery is calculated as follows:

$$\%Recovery = \frac{SSR - SR}{SA} x 100$$

where:

SSR	=	spiked sample result
SR	=	sample result
SA	=	spike added

The acceptance criteria are:

%R > 125%, Sample Results (SR) < CRDL - acceptable

%R 75% - 125%, SR > CRDL - acceptable

%R > 125% or < 75%, SR > CRDL - estimated (J)

%R 30% - 75%, SR < CRDL - estimated (UJ)

%R < 30%, SR < CRDL - unusable (R)

Note that low matrix spike recoveries for solid matrices may be indicative of sample mass interferences, rather than a laboratory performance problem.

Quantitative Review

Results should be reported in pCi/g solids (dry weight) and pCi/l water. Sample results should be reported to two significant figures. "Less Than" (LT) results should be reported to one significant figure.

The CRDLs established in the scope of work must be met. Analytical uncertainties should be reported with all results in order to qualify the data. Results and uncertainties should be reported for all required analyses regardless of the size or sign of the result. The reported uncertainty should be, at a minimum, the standard 2 sigma counting error. If a total uncertainty is propagated (including other sources of error in addition to counting error), it should be clearly stated and the equation used must be provided.

The raw data should be examined to verify the correct calculation of sample results reported on the summary form by the laboratory. Steps include:

1. Examine the raw data for any anomalies (i.e., omissions, legibility, etc.)

2. Verify that there are no transcription or reduction errors (e.g., dilutions, percent solids, sample weights, etc.) on one or more samples per analytical report.

3. Verify that counting uncertainties have been reported or otherwise documented. Verify that the uncertainty has been propagated as follows:

$$2\sigma uncertainty = \frac{1.96\sqrt{(C_s/t_s)+(C_b/t_b)}}{ExVolxRx2.22}$$

where:

C_s	=	Sample count rate, cpm
C_b	=	Background count rate, cpm
t_s	=	Sample count time, minutes
t_b	=	Background count time, minutes
E	=	Counting efficiency
Vol	=	Volume of sample (liters or grams)
R	=	Radiochemical recovery
2.22	=	Conversion factor from dpm to pCi

4. If uncertainty is expressed differently, evaluate the equation used and verify that it has been reported accurately.

5. Verify on one or more samples per analytical report that the minimum detectable concentration (MDC) has been properly calculated, using:

$$MDC(pCi/g;\ pCi/l) = \frac{4.65\sqrt{Bkg/t}}{ExVolxRx2.22}$$

where:

4.65	=	Statistical factor
Bkg	=	Background count rate in cpm
T	=	Count time
E	=	Counting efficiency

Vol	=	Volume of sample (liters or grams)
R	=	Radiochemical recovery
2.22	=	Conversion factor from dpm to pCi

Verify that the MDC is less than or equal to the CRDL. [Note: An MDC greater than the CRDL may indicate use of a small aliquot size for a sample with a relatively high concentration of the radionuclide(s) being measured. This may not be inappropriate, as long as the analytical result exceeds the MDC. If a different formula is used to calculate MDC, evaluate the formula and verify that it has been properly calculated.

Closely evaluate net negative results that have uncertainties smaller than the absolute value of the negative result. This may be an indication of improper background subtraction. Such results should be flagged as "estimated" (J). The laboratory should be contacted to determine if there is evidence of a background subtraction problem. If there is additional evidence of a background subtraction problem, flag the results as "unusable" (R).

If any discrepancies are found, the laboratory may be contacted by the designated representative to obtain additional information that could resolve any differences. If a discrepancy remains unresolved, the reviewer may determine that qualification of the data is warranted.

Validation Flags

Data results that do not meet the acceptance criteria are qualified with flags, which are single letter abbreviations that indicate a problem with the data. The following flags are used in this protocol:

- J Indicates the analyte is present, but the reported value may not be accurate or precise because the associated quality assurance was unacceptable.
- R Indicates the data are unusable. This flag is used when data results should not be used to support project decisions.

- UJ The sample was analyzed, but the analyte was not detected above the stated concentration. The result is reported as less than the MDC.

The following subqualifiers give further detail of the type and amount of qualification a given result has received.

- D Qualified because laboratory duplicate control limits were exceeded.
- S Qualified because matrix spike recovery control limits were exceeded.
- C Qualified due to instrument calibration problems.
- B Qualified due to blank contamination problems.
- Q Qualified due to reasons not stated above-refer to text of the report.

RADIOLOGICAL DATA REVIEW AND VALIDATION GUIDELINES
ISOTOPIC ANALYSES BY GAMMA SPECTROMETRY

LI TUNGSTEN - CAPTAIN'S COVE ADJUNCT
FOCUSSED FEASIBILITY STUDY

Scope and Applicability

This document provides guidance for the review of laboratory data packages and the validation of analytical sample results for gamma-emitting radionuclides of concern (or gamma-emitting decay products of radionuclides of concern generated via gamma spectrometry (hyper-pure Germanium) collected during the Captain's Cove Focussed Feasibility Study (FFS).

Currently, there are no standard methods for radiological data evaluation or validation that are equivalent to the U. S. Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) methods for chemical data. This document suggests areas for review of data packages and acceptance limits for the assessment and validation of radiochemistry results, based on accepted nuclear industry standards and draft data validation protocols used at Department of Energy (DOE) sites.

Purpose

The purpose of review and validation is to assure that the quality of each data point is known, and that each data point is flagged with a qualifier indicating the quality of that data point. In addition, data validation provides a review of laboratory quality control (QC) measures so that corrections to laboratory procedures can be implemented if necessary. It is assumed that field samplers and analytical laboratories have followed approved methods and adhere to good laboratory practices. This procedure provides guidelines for review and validation of radioanalytical data packages, and establishes criteria for applying appropriate data qualifiers to individual data points.

Criteria

The criteria used to evaluate data are based on the examination of sample holding time, instrument calibration, calibration verification, method blank analysis, duplicate analysis, instrument background, and quantitative review.

The laboratory will participate in an interlaboratory comparison crosscheck program (such as those operated by the USEPA, DOE's Environmental Measurements Laboratory, etc.). If the laboratory does not participate in such a program, or has not passed its most recent round of intercomparison measurements, all data will be flagged "unusable" (R).

Holding Times

All samples must be analyzed within 180 days of sample collection. Actual holding times are established by comparing the sampling date on the sample traffic report with the date of analysis found in the laboratory data (digestion logs and instrument run logs).

Analyte Holding Time (days) = Analysis Date - Sampling Date [Note: The holding time is calculated from the date of collection, rather than the verified time of sample receipt. It is a technical, not a contractual, requirement.].

If the holding time requirements are not met, qualify sample results < MDC "UJ". Sample results ≥ MDC may not require qualification; however, "J" may be designated, if necessary. If holding times are > 360 days, reject all associated data.

Detector Calibration

Instrument Calibration

For gamma ray measurements, the detectors must be calibrated to obtain the counting efficiency for each of the radionuclides with a mixed energy standard (approximately 150 - 1800 keV) traceable to the National Institute of Standards and Technology (NIST). Standard certificates must be provided. Each detector will be calibrated per manufacturer's instructions within one year of the analysis date.

Calibration of the gamma spectrometry system will achieve counting errors of 5% or less during the initial energy calibration. The detector resolution will be determined. The efficiency data for all geometries will be provided. If any of these initial calibrations have not been conducted, all data will be flagged "unusable" (R).

Calibration Verification

A calibration verification will be performed weekly to evaluate detector energy, efficiency, resolution, and background response. Sources will be used which contain nuclides which emit photons in approximately the same energy range of interest as the nuclides of interest in the samples. Failure to perform weekly calibration verifications will result in all data flagged "estimated" (J).

Weekly energy calibrations will document that the detector resolution is within $\pm$ 0.2 Full Width at Half Maximum (FWHM) determined from the initial calibration. The measured energy calibration values for the standard's photopeaks should be within $\pm$ 1 keV of the known energies. The results from any detector where the energy calibration is not within these control limits will be flagged "estimated" (J).

The detector efficiencies must also be monitored weekly for the appropriate geometries used to count the samples. The efficiency is calculated as follows:

$$Efficiency = \frac{C}{AxB}$$

where:

C	=	net count rate, cpm
A	=	activity in standard, dpm
B	=	gamma ray abundance, gamma/dpm

The measured efficiency should be within $\pm$ 10% of the values determined during the initial calibration. If the efficiency deviates outside of the control limit or if calibration verification has not been performed for the proper geometry, all data will be flagged "estimated" (J).

Detector Background

Backgrounds should be run on each detector at least monthly for gamma spectrometer systems. Count times should be at least as long as the sample count time. Recognizing that gamma spectrometry software packages utilize different methods to monitor background, the laboratory will provide a description of the methodology used at their facility to monitor background. All pertinent background data will be supplied covering the time period(s) when samples were counted such that the data validator may determine that the instrument background response was acceptable when samples were counted. If backgrounds were not run, or resulted in count rates outside of the control limits, all associated sample results will be flagged "estimated" (J).

Quality Control Samples

Quality control (QC) requirements for building material and soil samples are limited to analyses of duplicates at a frequency of one per batch of 20 samples. [Note: Method blanks are required for water samples which have been filtered in the laboratory. No such samples are targeted for gamma spectral analysis during the Captain's Cove FFS. They should be performed in like geometries, with similar count times, and on the same dates which the samples in the applicable batch are analyzed. If these parameters cannot be verified, the data will be flagged "estimated" (J). It is understood that there may not be sufficient sample mass to perform duplicate analyses on building material samples. If this is the case, appropriate documentation should be provided in the data package.

Duplicate Samples

A laboratory duplicate is a separate and equal aliquot of a homogenized sample. The duplicate samples provide an indication of laboratory precision.

A control limit of $\pm$ 35 percent for building material and soil samples for the relative percent difference (RPD) shall be used for sample values >5x the contract required detection limit (CRDL).

A control limit of $\pm$ 2x CRDL for building material and soil samples shall be used for sample values <5x the CRDL.

The RPD is calculated as follows:

$$RPD = \frac{|S-D|}{(S+D)/2} x100$$

where:

S	=	First sample value (original)
D	=	Second sample value (duplicate)

If duplicate analysis results for a particular radionuclide fall outside the appropriate control windows, qualify the results for that radionuclide in all associated samples of the same matrix as "estimated" (J).

Quantitative Review

Results should be reported in pCi/g solids (dry weight). Sample results should be reported to two significant figures. "Less Than" (LT) results should be reported to one significant figure.

The CRDLs established in the scope of work must be met. Analytical uncertainties should be reported with all results in order to qualify the data. Results and uncertainties should be reported for all required analyses regardless of the size or sign of the result. The reported uncertainty should be the standard 2 sigma counting error. If the error reported differs from the 2 sigma counting error, the equation used to calculate must be provided.

The laboratory will provide a description of the software package used to perform gamma ray spectral analysis. The data validator should be able to quantify the concentration of the radionuclides of interest from sample spectra printout. The photopeaks used should be within 2 keV of the energy used in the reference library for the particular radionuclide. If any discrepancies are found, or if the concentration calculation cannot be verified, flag the data as "estimated" (J).

The data provided on the gamma printout should also be examined to review several system parameters. These include:

- sample count date and time
- sample volume
- sample geometry
- percent dead time

If an inappropriate sample volume was used, flag the data as "estimated" (J). If the incorrect geometry was used, or if the percent dead time was greater than 10%, flag the data as "unusable" (R).

Verify on one or more samples per analytical report that the minimum detectable concentration (MDC) has been properly calculated, using:

$$MDC(pCi/g) = \frac{4.65\sqrt{BKG/t}}{ExBRxVolx2.22}$$

where:

4.65	=	Constant for 95% confidence
Bkg	=	Background count rate in cpm
T	=	Count time
E	=	Counting efficiency
BR	=	Branching Ratio
Vol	=	Sample mass, grams
2.22	=	Conversion factor from dpm to pCi

Verify that the MDC is less than or equal to the CRDL. An MDC greater than the CRDL may indicate use of a small sample size, inadequate count time, or matrix problem.

Closely evaluate net negative results that have uncertainties smaller than the absolute value of the negative result. This may be an indication of improper background subtraction. Such results should be flagged as "estimated" (J). The laboratory should be contacted to determine if there is evidence of a background subtraction problem. If there is additional evidence of a background subtraction problem, flag the results as "unusable" (R).

If any discrepancies are found, the laboratory may be contacted by the designated representative to obtain additional information that could resolve any differences. If a discrepancy remains unresolved, the reviewer may determine that qualification of the data is warranted.

Validation Flags

Data results that do not meet the acceptance criteria are qualified with flags, which are single letter abbreviations that indicate a problem with the data. The following flags are used in this protocol:

- J Indicates the analyte is present, but the reported value may not be accurate or precise because the associated quality assurance was unacceptable.
- R Indicates the data are unusable. This flag is used when data results
- UJ The sample was analyzed, but the analyte was not detected above the stated
concentration. The result is reported as less than the MDC.

The following subqualifiers give further detail of the type and amount of qualification a given result has received.

- D Qualified because laboratory duplicate control limits were exceeded.
- C Qualified due to instrument calibration problems.
- Q Qualified due to reasons not stated above-refer to text of the report.